The Engineer.

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VOL. CLI.—No. 3917] LONDON: FRIDAY EVENING, FEBRUARY 6, 1931 [PRICE {WITH SUPPLEMENT} ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

HEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Tuesday, 24th February, 1931, for LOW-PRESSURE HOT WATER HEATING at the Post Office Engineering Depot, &c., Buxton-street, Newcastle-on-Tyne.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 6462

The Director-General, India Store Department, Belvedere road, Lambeth, London, S.E. 1, invites TENDERS for :—

106,000 INDIA RUBBER SPRINGS for BUFFERS.

Tenders due 25th February, 1931.

Forms of Tender available from the above at a fee of 5s., which will not be returned. 6470

University of Birmingham.

FACULTY OF SCIENCE.

PROFESSORSHIP OF MECHANICAL ENGINEERING.

The Council of the University invites APPLICATIONS for the CHAIR of MECHANICAL ENGINEERING, vacant by the retirement of Professor F. W. Burstall.

The stipend offered is £1200 a year.

Twenty-four copies of applications, which may be accompanied by copies of not less than three testimonials, references, or other credentials, should be forwarded to the Registrar, The University, Edgbaston, Birmingham, to reach him not later than 9th March, 1931.

It is desirable that the selected candidate should enter upon his duties on the 1st of October next.

Further particulars may be obtained from

C. G. BURTON, Secretary.

6490

Middlesex Education Committee.

ACTON TECHNICAL COLLEGE, HIGH-STREET, ACTON, W. 3.

APPLICATIONS are INVITED for the APPOINTMENT of PRINCIPAL of ACTON TECHNICAL COLLEGE, to commence duty on 1st May, 1931. The College was opened in September, 1928, in new buildings, which will shortly be enlarged. The number of students on roll is 1750. The Departments of the College for which the Principal will be generally responsible, in addition to the supervision of all other evening classes (roll 750), provided by the Middlesex Education Committee in the Borough of Acton, include :—

Junior Technical School (Engineering).

Part-time Day Classes.

Evening Continuation Classes.

Approved part-time courses are conducted at the College for Advanced National Certificates in Engineering (Mechanical and Electrical), and in Building and Chemistry (Ordinary Grade).

It is desirable that candidates should possess industrial experience in addition to satisfactory academic and professional qualifications, and should give evidence of ability to work in close co-operation with employers in industry.

Salary £750-£25-£1000. The appointment will be subject to satisfactory medical examination.

Application forms may be obtained by sending a stamped addressed foolscap envelope to the undersigned, to whom completed forms must be returned not later than Saturday, 14th February.

H. M. WALTON, Secretary (F),
10, Great George-street, Westminster, S.W. 1.

6447

City of Bradford.

The Bradford Corporation invite TENDERS for—

CONTRACT "R 420"—TWO WATER-TUBE BOILERS.

Copies of the conditions of contract, specification and form of Tender may be obtained from Mr. Thomas Roles, M.I.E.E., City Electrical Engineer, Electricity Offices, 45 to 53, Sunbridge-road, Bradford, on payment of the sum of Two Guineas, which sum will be refunded only upon the receipt of a bona fide Tender, with the return of the documents in good condition, and after the Tenders have been adjudicated upon.

Sealed Tenders on the forms provided, must be sent to the undersigned, duly completed, not later than 10 a.m. on Thursday, the 5th March, 1931, endorsed, "Tender for Electricity Works—Contract 'R 420.'"

The contract will be let subject to the Fair Contracts Clauses of the Corporation, which may be seen at my office, and which the accepted contractor will be required to sign.

The lowest or any Tender will not necessarily be accepted.

N. L. FLEMING, Town Clerk.

Town Hall, Bradford,
4th February, 1931. 6475

Metropolitan Water Board.

TENDERS FOR THE SUPPLY OF CAST IRON PIPES.

The Metropolitan Water Board invite TENDERS for the SUPPLY of CAST IRON STRAIGHT PIPES and SPECIALS for the periods of six and twelve months, commencing 1st April, 1931.

Tenders must be submitted on the official forms (Tender No. 3), which may be obtained on and after Monday, 9th February, 1931, from the Chief Engineer, by personal application at the offices of the Board (Room 156) or upon forwarding a stamped addressed sack envelope.

Tenders, enclosed in sealed envelopes, addressed to the Clerk of the Board and endorsed "Tender for Cast Iron Pipes," must be delivered at the offices of the Board (Room 122) not later than 11 a.m. on Monday, 2nd March, 1931.

The Board do not bind themselves to accept the lowest or any Tender.

G. F. STRINGER, Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1,
30th January, 1931. 6463

The Engineer

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PUBLIC NOTICES

Metropolitan Water Board.

TENDERS FOR THE SUPPLY OF PHOTO PRINTS, &c.

The Metropolitan Water Board invite TENDERS for the SUPPLY of PHOTO PRINTS, &c., for the periods of six and twelve months, commencing 1st April, 1931.

Tenders must be submitted on the official forms (Tender No. 27), which may be obtained on and after Monday, 9th February, 1931, from the Chief Engineer, 173, Rosebery-avenue, E.C. 1, by personal application at the offices of the Board (Room 156) or upon forwarding a stamped addressed sack envelope. Samples of the paper required can be seen at the offices of the Board (Room 201).

Tenders, enclosed in sealed envelopes addressed to the Clerk of the Board and endorsed "Tender for Photo Prints, &c.," must be delivered at the offices of the Board (Room 122) not later than 11 a.m. on Monday, 2nd March, 1931.

The Board do not bind themselves to accept the lowest or any Tender.

G. F. STRINGER, Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1,
30th January, 1931. 6464

The County of London Electric SUPPLY CO., LTD.

BARKING POWER STATION EXTENSIONS, 1930.

TENDERS FOR THE CONSTRUCTION OF FOUNDATIONS AND BUILDINGS.

The County of London Electric Supply Company, Limited, are prepared to receive TENDERS for the CONSTRUCTION of FOUNDATIONS and BUILDINGS in connection with extensions to the Power Station at Barking.

The specification, schedule and form of Tender may be obtained by contractors by application to Sir Alexander Gibb and Partners, Queen Anne's Lodge, Westminster, S.W. 1, where the drawings may be seen, on or after Friday, 6th February, 1931, and on a payment of a fee of £5 5s. for the first copy, and £2 2s. for every subsequent copy. Sums paid for any number of copies up to three will be refunded on receipt of a bona fide Tender.

Sealed Tenders, endorsed "Tender for Foundations and Buildings Contract," must be delivered to the CHAIRMAN and MANAGING DIRECTOR, The County of London Electric Supply Co., Ltd., County House, 46/47, New Broad-street, London, E.C. 2, not later than Noon on Wednesday, 25th February, 1931.

The Company do not bind themselves to accept the lowest or any Tender. 6446

PUBLIC NOTICES

Portsmouth City Mental HOSPITAL.

BOILER INSTALLATION.

The Committee of Visitors of the Portsmouth City Mental Hospital purpose making alterations to their present boiler system, and invite SPECIFICATIONS and ESTIMATES for the IMPROVEMENT of their present INSTALLATION.

The present installation may be inspected on any day between the hours of 10 a.m. and 4 p.m. on application to the undersigned.

Suggestions with full Specifications and Estimates must be endorsed "Boilers," and addressed to the Chairman, Committee of Visitors, Portsmouth City Mental Hospital, Milton, Portsmouth, to be delivered before 10 a.m. on Monday, 2nd March, 1931.

The Committee do not bind themselves to accept the lowest or any Tender.

JOHN C. KERSEY, Clerk and Steward.

30th January, 1931. 6448

The Madras and Southern MAHRATTA RAILWAY COMPANY, Limited, invite TENDERS for—

(1) COPPER RODS, TUBES and SHEETS.
(2) 72,000 BEARING PLATES.
(3) 350,000 DOGSPIKES.
(4) 66,000 FISH-BOLTS.

Tenders are due in on Tuesday, 24th February, 1931, by 2.00 p.m. Tender forms obtainable at address below; fee for Nos. (1) and (2) ONE GUINEA each, and for Nos. (3) and (4) HALF A GUINEA each, WHICH IS NOT RETURNABLE.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices,
25, Buckingham Palace-road, Westminster, S.W. 1. 6473

The South Metropolitan Gas COMPANY invite APPLICATIONS for the POSITION of RESIDENT ENGINEER of their Rotherhithe Works, within half a mile of which the house is situated.

Full particulars of the appointment and its emoluments will be furnished to intending applicants in reply to their written inquiries to the undersigned.

FRANK DAY, Secretary.

South Metropolitan Gas Company,
709, Old Kent-road, S.E. 15. 6482

PUBLIC NOTICES

For Sale.

DRAGLINE EXCAVATOR MACHINES.

Owing to the approaching completion of the Lloyd Barrage Canals, various types and sizes of Steam and Diesel-driven DRAGLINE EXCAVATORS, with spares and subsidiary plant, are available now or in the near future FOR SALE. The machines are all in good working condition, and each type may be personally inspected at work.

Full details of types, specifications, working outputs, working rates, fuel consumption, &c., sale price and other information available to bona fide inquirers on application to—

THE EXECUTIVE ENGINEER,
Draglines Division,
Barrage Township,
Sukkur, Sind,
India,
or
C. S. C. HARRISON,
Chief Engineer, Lloyd Barrage and Canals Construction,
Karachi.

Dated 27th January, 1931. 6494

Metropolitan Water Board.

APPOINTMENT OF TWO CIVIL ENGINEERING DRAUGHTSMEN.

The Metropolitan Water Board invite APPLICATIONS for the above-mentioned POSITIONS, at an inclusive salary of £5 5s. per week in each case.

Applicants must be good Draughtsmen and Surveyors, conversant with the use of Level and Theodolite and preferably with some knowledge of Waterworks.

Applications, in candidates' own handwriting, stating age, full particulars of training, qualifications and previous experience, together with copies of not more than two testimonials, should be addressed to Mr. Henry E. Stillgoe, M. Inst. C.E., the Chief Engineer, and must reach the offices of the Board not later than the 16th February, 1931.

Canvassing will be held to be a disqualification.

G. F. STRINGER, Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1,
4th February, 1931. 6476

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED by Firm of Engineers, MERCHANTS and REPRESENTATIVE for Sale of First-class Specialities; good salary, commission and expenses and car provided to suitable applicant who would invest up to £2000 in business, which would be guaranteed.—Address, P759, The Engineer Office. P759 A

WANTED for Yorkshire, ASSISTANT in COST DEPARTMENT, fully conversant with modern methods, able to supervise and show results, knowledge of general accounts essential. Full particulars of experience, age, and wage required, in confidence.—Address, 6484, The Engineer Office. 6484 A

AIRCRAFT STRUCTURAL TESTING LABORATORY REQUIRES ASSISTANTS; start, 50s.; technical qualifications essential.—Address, P757, The Engineer Office. P757 A

ENGINEER SALESMAN REQD. Straits Settlements. Age 22/26, single. Pub. School educ., Eng. degree an asset. Good exp. Com. sal. £450 with annual increments.—Apply, LAURIE and CO., Employment Specialists, 28, Basinghall-st., E.C. 2. No preliminary fee. P746 A

ENGINEER SALESMAN REQD. F.M.S., with Exp. Constr. and Builders' Materials, Reinforced Concrete, &c. Able supervise contracting dept. Single, 22/26, well educated. Start at £450 p.a.—Apply, LAURIE and CO., Employment Specialists, 28, Basinghall-st., E.C. 2. No. preliminary fee. P747 A

OLD-ESTABLISHED FIRM of HEATING ENGINEERS in Lancashire REQUIRE the SERVICES of a DRAUGHTSMAN, with experience of all Modern Systems of Heating, Hot Water Supply, Ventilating and Drying Plants. Applicants must be first-class Designers, with experience of Supervising Installations, quick and accurate and capable of Controlling Staff. To right applicant substantial commencing remuneration will be paid.

Address, in confidence, stating age, experience and salary expected, to 6436, The Engineer Office. 6436 A

PROGRESS ENGINEER WANTED in Small Works for Correspondence and Stores Control.—Address, fully, P730, The Engineer Office. P730 A

REQUIRED AT ONCE, Experienced LIFT ENGINEER for provinces, capable of Testing and Handing Over Lift Installations. Only men accustomed to highest class work need apply. The position is one which offers scope for advancement for an energetic man aged about 30 years. Give particulars of age, experience and salary.

Address, 6485, The Engineer Office. 6485 A

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PUBLIC NOTICE

Government of Bombay.

NOTICE.

To IRRIGATION DEPARTMENTS, PORT AUTHORITIES, RAILWAYS, MUNICIPALITIES, ELECTRIC SUPPLY COMPANIES, PUBLIC WORKS CONTRACTORS AND OTHER ADMINISTRATIONS CARRYING OUT LARGE ENGINEERING WORKS.

Notice is hereby given that, owing to the approaching completion of the Lloyd Barrage at Sukkur, large quantities of Plant and Machinery as briefly detailed in the list below will shortly become available for sale. The bulk of the plant will not be available until after June, 1931, but some plant is now available and other plant will become available shortly.

All Administrations who have works in progress or who are contemplating works in the near future are invited to consider the subjoined list and to apply to the undersigned for full particulars and prices of any plant which might be of use to them. Enquiries are NOT invited from machinery dealers at the present stage. Most of the plant was purchased new for these works and is in excellent condition. Every item of plant sold will be first overhauled and put in thorough working order before sale and will be open for inspection (and test, wherever possible) by appointment at Sukkur.

Service will also be given after sale and purchasers' men will be trained by arrangements, as long as the Barrage Construction Works and Shops are in existence.

A. A. MUSTO,
C.I.E., M.I.C.E., I.S.E.,
Superintending Engineer, Lloyd Barrage Circle.

Postal Address: Sukkur, Sind, India. Cables: "SUKBAR, SUKKUR."

LIST OF PLANT & MACHINERY.

RAILWAYS.

About 40 miles of 5ft. 6in. gauge Railway complete and 9 Steam Locomotives and about 700 Wagons of all types, including 20-Ton Either-side Tipping Wagons. About 25 miles 2ft. gauge Railway complete and 15 Kerosene and 2 Steam Locos. and about 1100 Either-side Steel Tip Wagons of 27 cubic feet capacity.

FLEET.

Two Shallow-draught Suction Dredgers, by Lobnitz, 20in. discharge, to dredge to 30ft. each, complete with 1000ft. Floating Pipe Line and Terminal Pontoon with 150ft. overhang at 40ft. above water line.

Also Shallow-draught Paddle and Twin-screw Tugs, Motor Launches, Steel Barges, Pontoons, &c.

NOTE.—All motors on electrically driven plant are for A.C., 400 volts, 3-phase, 50 periods.

CRANES.

25-Ton and 10-Ton Electric Floating Derrick Cranes, 10-Ton and 1½-Ton Electric Derrick Cranes, 20-Ton and 2-Ton Steam Derrick Cranes. Also 5-Ton Steam Loco. Cranes and 10-Ton Electric Loco. Cranes, 5ft. 6in. gauge. Also 15-Ton, 12-Ton and 5-Ton Electric Goliath Cranes, 15-Ton Electric Shop Gantry Crane, and 15-Ton Hand-operated All-round Derrick Cranes.

PUMPS.

Sets of 8in., 4in., 3in., and 2in. Direct-coupled Electric Centrifugal Pumps for 40ft. head.

PILE DRIVERS.

Floating and Land Sets with McKiernan-Terry Double-acting Piling Hammers, Spencer-Hopwood Boilers, Zenith Winches and Steel Frames and Leads for driving 45ft. Piling.

STONE CRUSHERS.

"Acme" Jaw Crushers, 24in. by 15in., with Elevators, Hoppers and Screens and Portable, Crusher, 12in. by 6in.

CONCRETE MIXERS.

Complete Plants for Moulding 10-Ton Blocks with Travelling Mixer Bridge carrying 2-Yard Ransome Mixers complete with Bunkers, Elevators and Batch Measuring Hoppers for materials, all electric driven. Also Steel Moulds for 10-Ton and 1½-Ton Blocks. Also Electric-driven Portable Mixers of sizes.

AIR COMPRESSORS.

Direct-coupled Electric-driven Sentinel Two-stage Compressors of 300 cubic feet capacity. Belt Drive Ditto of 550, 300, 188, and 140 cubic feet capacity respectively. Pneumatic Tools of all kinds.

DIVING GEAR AND DRESSES, &c.

ELECTRIC POWER PLANT.

Following Diesel Engines direct coupled to Alternators generating A.C., 6600 volts, 3-phase, 50 periods:—

2 Swiss Loco. 4-Cylinder Single-acting Diesels, 750 B.H.P., with Fly-wheel Alternator, 500 kW. by Oerlikon.
2 Fullagar 4-Cylinder Double-acting Diesels, 750 B.H.P., with Fly-wheel and Alternators, by English Electric Co., 500 kW.
2 Mirrlees, Bickerton and Day 6-Cylinder Single-acting Diesels, 300 H.P., with Metro-Vickers Alternators, 175 kW.
Metro-Vickers Cubicle Type Switchboard.
Johnson and Phillips Transformers, 6600 to 400 volts, of sizes.
H.T. and L.T. Overhead Transmission Poles, Cables, &c.

MORTAR MILLS.

Both Over-driven and Under-driven Type Mortar Mills, 8ft. dia. pans, with belt drive from countershaft.

WORKSHOP MACHINERY.

Lathes, Shapers, Planers, Milling Machines, Drilling Machines, Belt Air Hammers, Belt Hammers, Punching and Shearing Machines, Forges, Woodworking Machinery, Plate Rolls, Iron and Brass foundry Equipment, Saw Sharpening Machines, &c.

QUARRY PLANT.

Compressed Air Drills of all sizes, Forging Machines, Oil Furnaces, Air Compressors, Oil Engines, Wire Saws, Channellers, &c.

STONE DRESSING PLANT.

Diamond Saws, Planers, Frame Saws, Rip Saws, Countershafts, &c.

ENGINES.

Oil Engines of various sizes.

BUILDINGS.

Steel-framed Stone Dressing Shop, 360ft. by 115ft., with 15-Ton Gantry Runway and numerous Smaller Steel Roof Trusses, &c.

STEEL SHEET PILING.

About 11,000 Tons "Universal" 15in. by 5in. by 43 lb. per square foot Interlocking S.S. Piling in 40ft., 45ft., and 50ft. lengths.

MISCELLANEOUS PLANT.

Such as Steel Riveted and Sectional Tanks of all sizes, with and without Staging, Winches, Jacks, Pulleys, Wire Ropes, Motor Lorries, and many other items.

A. A. MUSTO,
S.E.I.B.C.

MS.19/10. P.B. 40/30. 6445

SITUATIONS OPEN (continued)

SALES MANAGER.—Old-established FIRM of IRONFOUNDERS, supplying the building trades, REQUIRES the SERVICES of an experienced SALES MANAGER. Fullest particulars, including salary, to be given.—Address, 6472, The Engineer Office. 6472 A

WATERWORKS ENGINEERING ASSISTANT REQUIRED, London district; must have practical and theoretical experience in large Waterworks Schemes, including Reinforced Concrete Construction, modern Steam, Oil, and Electrical Pumping Machinery, Distribution Systems, &c. Preference to A.M.I.C.E. State fully age, experience, qualifications, and salary required.—Address applications, accompanied with testimonials, to 6483, The Engineer Office. 6483 A

WORKS MANAGER WANTED for Modern Works in London district, employing 1000 hands, engaged in the Manufacture of Light Electrical Products. Applicants should be young, energetic, and able to control labour.
Previous experience in similar capacity essential. Designing experience an advantage. Good prospects for right man. State age and salary required.
Address, 6433, The Engineer Office. 6433 A

WANTED, for Midland Colliery, an ASSISTANT MECHANICAL DRAUGHTSMAN. Full details of training and wages required, with copies of three references.—Address, 6442, The Engineer Office. 6442 A

WANTED, for Colliery in Yorkshire, Experienced DRAUGHTSMAN, able to Design General Colliery Plant. State experience, age and wages required.—Address, 6443, The Engineer Office. 6443 A

CHIEF DRAUGHTSMAN REQUIRED, Thoroughly experienced in the organisation of drawing-office engaged in large variety of prime movers, both oil and steam.
Address, stating age, experience, and salary required, 6423, The Engineer Office. 6423 A

DRAUGHTSMEN WANTED by an Electrical Firm, familiar with Control Gear or Switchgear.—Address, stating age, experience, and salary required, 6477, The Engineer Office. 6477 A

FIRST-CLASS DRAUGHTSMAN DESIGNER WANTED AT ONCE on North-East Coast for High-efficiency Centrifugal Multi stage Pumps; production, testing and estimating experience essential; knowledge of other types of pumps—ram, direct-acting, steam, &c.—an advantage. State detailed experience, salary required, and when at liberty.—Address, 6488, The Engineer Office. 6488 A

JUNIOR DRAUGHTSMAN REQUIRED in London. Works experience an asset.—Address, 6489, The Engineer Office. 6489 A

JUNIOR DRAUGHTSMAN WANTED by Chemical Plant Engineers in S.E. London. Particulars and salary required.—Address, P755, The Engineer Office. P755 A

REQUIRED, Smart DRAUGHTSMAN; Must Have knowledge of Electric Automatic Refrigerators.—Address, 6460, The Engineer Office. 6460 A

TECHNICAL DRAUGHTSMAN REQUIRED, with knowledge and experience of the Calculations and Constructions for all classes of Ropes. Preference given to one with some practical experience.—Address, giving full details of age, experience, and salary required, 6487, The Engineer Office. 6487 A

SITUATIONS WANTED

COSTS and Works Accountancy. Highly Experienced MAN DESIRES ADMINISTRATIVE POSITION. Accurate production, process, and overhead costs, stores control, rate fixing, and general works and office organisation. Any size concern.—Address, P752, The Engineer Office. P752 B

ENGINEER (23), 5 Years Mechanical Training, 4 years technical, 2 years D.O., WISHES to obtain POST, S.E. England. Thoroughly capable. Highest credentials, character and ability.—Address, P738, The Engineer Office. P738 B

ENGINEER, M.I. Mech. E., Iron and Steel Works' training, mechanical and electrical, practical in all branches, several years chief engineer and maintenance manager in large works in Midlands and in Sheffield, conversant with modern blast-furnace and steel works practice, &c., DESIRES SUITABLE POST. Age 43.
Address, P723, The Engineer Office. P723 B

ENGINEER (44), 8½ Years Chief Dr. on Gen. Eng. on loco. and winding engines, 2 years assist. wks. manr., Diesels and agr. machinery. £400 p.a.—Address, P744, The Engineer Office. P744 B

ENGINEER SALESMAN, Dust Recovery and Air filtration plant experience, proved industrial connection, open new accounts; salary, expenses and commission turnover.—Address, P745, The Engineer Office. P745 B

EXPERIENCED BUSINESS GENTLEMAN, Well introduced and with influential connection engineering concerns, SEEKS suitable OPENING or would UNDERTAKE SALES ORGANISATION. Strictest confidence.—Box A.Y., W. H. Smith and Son, Ltd., Hambleden House, Sheffield. 6481 B

EXPORT.—ADVERTISER, Desiring Greater Scope, OFFERS SERVICES, Foreign Sales Manager or similar; good technical and mechanical experience, extensively travelled, fluent French and German with good knowledge other languages, accustomed organisation, control and negotiation export business.—Address, P750, The Engineer Office. P750 B

M. INST. C.E., M.I. MECH. E., with Exceptional experience in design, construction and maintenance of large public works, DESIRES Executive or Administrative APPOINTMENT with engineering practice or advisory work, specialising in water supply.—Address, P731, The Engineer Office. P731 B

SITUATIONS WANTED (continued)

SALES ENGINEER (29), B.Sc., A.M.I.A.E., DESIRES CHANGE, with industrial or automobile firm seeking expansion overseas; now sales manager leading American corporation exporting cars and accessories; excellent connections; languages.—Address, P742, The Engineer Office. P742 B

YOUNG ENGLISH SALES ENGINEER (27), Single, at present engaged in Canada, DESIRES POST, preferably in Canadian Sales Dept. of English Engineering Firm, either in England or Canada. Responsible position only considered.—Apply, P.O. Box 542, Toronto, Canada. 6479 B

YOUNG ENGINEER, Stud. I.E.T., DESIRES POST, maintenance or progressive post. Excel. refs., railway shop and marine engineer, technical and practical.—Address, P732, The Engineer Office. P732 B

YOUNG MAN, with D.O. and Practical Rotary Kiln, clinker grinding, quarrying, cement loading, &c., experience, SEEKS POSITION as ASSIST. MANAGER or similar on Cement Works in Spain. Some Spanish.—Address, P736, The Engineer Office. P736 B

DRAUGHTSMAN (24), Experienced in General engineering, elevating and conveying, marine auxiliaries and refrig. plant, SEEKS POST.—Address, P753, The Engineer Office. P753 B

FOREMAN (Disengaged), Expert in Production bridge, structural, heavy circ. tank and general plate work, DESIRES similar POSITION. Sound knowledge electric welding, keen estimator, and piece work prices. Go anywhere.—Address, P735, The Engineer Office. P735 B

FOREMAN ENGINEER, Automatic and General machine shop practice, mass production methods, control all classes labour, DESIRES CHANGE, and SEEKS SUPERVISORY or REPRESENTATIVE POSITION.—87, Willingdon-road, N. 22. P737 B

FITTER (31), 12 Years Royal Navy, DESIRES Progressive POST, London, home counties preferred. Maintenance turbines, reciprocating engines, pumps, refrigerators; knowledge of internal combustion engines and turning; correspondence student.—ROWE, 88, Second-avenue, Gillingham, Kent. P734 B

PARTNERSHIPS

GENTLEMAN (28), Public School and Honours Natural Science Degree, Cambridge, 5 years' experience in Oil Production, Fields, and Refineries, English and American, WISHES to OBTAIN INTEREST and EXECUTIVE POSITION in private or limited company. Willing invest reasonable amount capital in sound business.
Reply to "INDUSTRY," c.o. Ed. J. Burrow and Co., Ltd., 43, Kingsway, W.C. 2. P758 C

EDUCATIONAL

Correspondence Courses
OF PREPARATION FOR THE
Examinations
OF THE
INST. OF CIVIL ENGINEERS.
INST. OF MECHANICAL ENGRS.
INST. OF STRUCTURAL ENGRS.
UNIVERSITY OF LONDON, &c.
ARE PERSONALLY CONDUCTED BY
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B.Sc., Honours, Engineering, London University. Assoc. M. Inst. C.E., A.M.I. Struc. E., M.R.S.I., F.R.S.A., Chartered Civil Engineer, &c.
For full particulars and advice, apply to:—
36, DALE STREET, LIVERPOOL.
LONDON OFFICE:—65, CHANCERY LANE, W.C. 2.

CORRESPONDENCE COURSE in DRAUGHTSMANSHIP for all Technical Examinations.
P. PITMAN, M.I. Mech. E.,
P761 B 25, Victoria-street, S.W. 1.

Oxford Correspondence College,
BEAUMONT HOUSE, OXFORD.
THOROUGH POSTAL PREPARATION FOR:—
B.Sc. (ENGINEERING), Pass and Honours.
A.M.I.C.E.,
A.M.I.M.E.,
and also Electrical, Structural, Aeronautical, Automobile and Marine Engineering Examinations.
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A Seven-Day Journal

Engineers' Wages.

A CONFERENCE to consider the whole question of wages and working conditions in the engineering trade was held last Friday, January 30th, on the invitation of the Engineering and Allied Employers' National Federation to the forty-two unions concerned. Statistical data derived from official sources with regard to the state of trade and employment, imports and exports, and the cost of living were supplied to the unions to support the contention of the Federation that the depression affecting industry really demanded an alteration of working conditions. Sir Allan Smith, for the Federation, put forward the following proposals:—That the working week should be one of forty-eight hours instead of forty-seven; that there should be a reduction in the overtime rate, which at present stands at time and one-half; that night shift rates should be reduced; and that the two questions of the manning of machines and the demarcation of labour should be seriously considered with a view to settlement. He also indicated that if employers could obtain relief in respect of the rates for overtime and night shift work, together with a certain elasticity in working arrangements, they would be much more capable of meeting competition successfully. Mr. W. H. Hutchinson, President of the Amalgamated Engineering Union, speaking on behalf of the unions, stated that the points put forward by the employers would be considered. There was some satisfaction among the representatives of the unions that no variation of the standard wage rates was suggested. Another conference will be held early next month, at which the unions will give their reply.

Lee Conservancy Works.

ON Monday, February 2nd, work was started on a scheme for the improvement of the channel of the river Lee. Mr. Hartshorn, Lord Privy Seal, and Mr. Lansbury, First Commissioner of Works, attended the opening ceremony. The scheme, which is estimated to cost £745,000 and provide employment for 450 men for four years, has three main objects. The Borough of West Ham and adjacent districts will be relieved of the danger of floods; hygienic conditions in relation to the waterways will be improved; and the navigation of certain back rivers will be facilitated. Between Lea Bridge-road and Carpenter's-road dredging work will be undertaken, while the back rivers known as the Waterworks River, Three Mills Wall River and City Mills River will be cleared. All these streams will be widened and it is intended that a new cut from the City Mills to the Bow Back River shall be constructed. Parts of the Three Mills Back River and the Pudding Mill River, together with certain waterways near Stratford High-street, are to be filled in and the land reclaimed and another by-pass channel will be constructed to connect the Three Mills Wall River with the Channelsea River. On the old river Lee a number of locks will be constructed to relieve the barge traffic. The Waterworks River and the Three Mills Wall River are to be given a general width of 100ft., the channel being designed to carry the main flow of the flood water. The work necessitates the acquisition of a number of properties and the demolition of many dwelling-houses.

The Whitehaven Pit Disaster.

ON the evening of Thursday, January 29th, the Haig Pit at Whitehaven was the scene of a disaster caused, it is stated, by an explosion. About 200 men were in the mine at the time and twenty-six of them lost their lives. The disaster occurred at a point in the workings two miles under the sea. No shots, it is stated, were being fired at the time, and for the present the cause of the explosion is not known. An official inquiry into it is to be held. The Haig Pit has suffered badly from explosions in recent years. In 1922 a disaster occurred in which thirty-nine lives were lost. In December, 1927, four men were killed by an explosion in the mine, and in February, 1928, thirteen men of an exploring party searching for the body of one of the victims of the December accident were killed as the result of an explosion. The pit adjoins the Wellington Pit, in which in 1910 a series of explosions followed by fire occurred, with the loss of 136 lives.

The Oil-Electric Tanker Permian.

AT the recent launch of the "Permian," which is the third oil-electric tanker to be constructed by Scott's Shipbuilding and Engineering Company, Ltd., Mr. James Brown referred to the very international character of the vessel. The shell plates, he stated, came from Czechoslovakia and the main engines from Belgium, while part of the auxiliary machinery was made in America, and the main electric propelling installation in Rugby. The ship was built by Scottish workmen for American owners, and she was registered in Panama, while she would, he understood, be navigated by Norwegian sailors. The new vessel was launched from the firm's East Yard at Greenock on Saturday last, January 31st. She has a length of 469ft. with a beam of 63ft. and a depth of 36ft. 9in., with a measurement of about 9000 gross tons. Her special design on the longitudinal system will enable her to carry about 14,200 tons of spirit oil on a light draught. Like her two sister ships, the "Brunswick" and the "Winkler," her propelling machinery will be controlled directly from the bridge, and the whole of the accommodation for officers and crew is arranged in or on the poops. The general lay-out of the machinery is similar to that of the "Brunswick," and comprises four single-acting, four-stroke, Carels-Ingersoll-Rand engines coupled to British Thomson-Houston main and auxiliary generators, which will supply current to a single propelling motor, which is a double armature machine with a designed output of 2800 S.H.P. at 95 r.p.m. The current will be supplied to the motor at 1000 volts, the four 600-kW main generators each being 250-volt machines, working in series with each other. The whole of the electrical installation was supplied by the British Thomson-Houston Company, Ltd., and the electro-hydraulic steering gear was built by John Hastie and Co., Ltd., of Greenock. The vessel is equipped with a gyro-pilot for automatic steering.

Gas and Electricity Undertakings.

STRONG criticism of the action of the Minister of Transport, Mr. Herbert Morrison, in throwing the weight of his influence on the side of the interests of electricity and against those of the gas industry was contained in the annual report of the directors of the South Metropolitan Gas Company, which was sent to the shareholders last week and presented at the annual general meeting on February 4th. In America, says the report, "the suppliers of electric and of gaseous energy have been left to compete for business as commercial undertakings, existing for the general weal and without discouragement of either by the Government. In this country, on the other hand, the Minister of Transport has seen fit to throw the weight of his influence into the scale on the side of the interests of electricity, and therefore to that extent to the detriment of gas. It is obvious that the arbitrary displacement and compulsory exclusion of gas in favour of electricity must involve a definite loss of business to the gas undertaking. An industry which for more than a century has fulfilled and is fulfilling a great purpose in the economic utilisation of the country's coal resources, which in London alone gives employment to some thirty thousand persons, excluding those employed in ancillary undertakings, and which continued to function unaided when electric power stations had to be manned by naval ratings during the general strike, surely deserves better recognition from the Government responsible for the health and welfare of the country." The report is signed on behalf of the board of the company by Dr. Charles Carpenter, who is president and managing director.

The Government and the Schneider Race.

ON Thursday, January 29th, the Prime Minister announced in the House of Commons that the Government, following representations which had been made to it, was now prepared to authorise the Royal Air Force again to defend the Schneider Trophy, and to provide assistance as in 1929, provided a definite undertaking were immediately given that the necessary funds would be made available from private sources. Almost immediately after Mr. MacDonald had made this statement, a private citizen, Lady Houston, offered to provide £100,000 to cover the expenses. The race, it is understood, will take place over the Solent, as in 1929, and will probably be held either in the last week of August or the first week of September. Precisely what machines will compose the British team is at present uncertain. The two Supermarine Rolls-Royce "S 6" seaplanes, which took part in the 1929 contest, are still available, and it is conceivable that a new machine might yet be built in the short time remaining. It is, however, undesirable to discuss the plans which are likely to be followed, for both the French and the Italian authorities are making their preparations in great secrecy, and it is therefore in this country's interest to pursue a similar course.

The Brown-Firth Amalgamation.

LAST year a scheme was approved for the reorganisation of the affairs of John Brown and Co., Ltd., of Sheffield and Clydebank. Included in that scheme was a proposal for the rationalisation of the company's Atlas and Scunthorpe works. The debenture holders gave the directors authority to sell or transfer these works to any other company or amalgamation of companies on condition that any shares, &c., received in consideration for the sale or transference should be held in trust for the debenture holders. As a first step towards the contemplated rationalisation, it has been arranged to sell and transfer the Atlas and Scunthorpe works and certain associated assets to Thomas Firth and Sons, Ltd. Messrs. Brown are already largely interested in Messrs. Firth's business, to the extent that they hold the majority of Firth's issued ordinary shares. The details of the new arrangement involve the creation of a first mortgage for £600,000 on the Atlas and Scunthorpe works in favour of the debenture holders. This mortgage will carry interest at 6 per cent., and will be repayable by fixed annual payments, beginning in January, 1936, and ending in January, 1965. In addition, Messrs. Firth will create 450,000 new ordinary £1 shares which will be transferred to Messrs. Brown in consideration of the handing over to Messrs. Firth of the stock-in-trade, stores, tools, work in progress, and similar assets connected with the Atlas and Scunthorpe works. The arrangement now awaits the sanction of Messrs. Brown's debenture holders and Messrs. Firth's shareholders. In a circular issued to their debenture holders, Messrs. Brown intimate that when the proposed amalgamation has been made effective the way will be clear for widening the basis of rationalisation in the heavy steel industry by bringing other businesses under one control.

Railwaymen's Pay.

ON Monday the National Wages Board resumed the hearing of the claims of the railway companies for alterations to the wages and working conditions of their salaried staffs. Before the adjournment on January 22nd, Mr. Lazenby, speaking for the companies, had made a general reply to the contentions of the unions. On Monday he started to reply in fuller detail and concluded his address on Tuesday. Amongst many other points he dealt with the criticism by Mr. Bromley of "the faulty finance and bad management of the railways." He maintained that if the total of £54,000,000 now accumulated in the renewal funds of the groups was used in part to pay the dividends of the shareholders as had been suggested, the ability of the companies to keep their business going with proper efficiency would be seriously impaired. General reserves, from which dividends could be paid, he said, had fallen from £34,603,960 in 1923 to £7,528,268 in 1929. Continuing his address on Tuesday, Mr. Lazenby pointed out that the conditions imposed upon the companies by the guaranteed day and guaranteed week were of a restrictive and expensive nature. Owing to those conditions, the availability of enginemen and adjustments to meet fluctuations in traffic were very much hampered, and, in addition, the companies had to pay out very large sums for hours not actually worked. He asked that the railways should be placed in such a position that traffic which they had lost could be won back and the requirements of industry met. Answering a question asked by Mr. Bromley, he said that in a recent instance the Great Western Railway had in one week made payments for 33,680 hours which had not been worked.

The Proposed Irak Pipe-Line.

A CONVENTION between the Government of Palestine and the Irak Petroleum Company, Ltd., has been signed in Jerusalem, giving the company permission to construct a pipe-line through Palestinian territory to the Bay of Acre, on which the Port of Haifa is situated at which an oil port will be built. The convention, which is contingent on the conclusion of a similar agreement with the Government of Irak, has been signed by the High Commissioner of Palestine. The proposal is that the line should have two forked branches, one, probably, reaching the sea at Tripolis, in the Lebanon Republic, and the other at Haifa. The Palestine concession is given for 70 years, after which, that part of the pipe-line which is in Palestine is to become the property of the Government of that country. The High Commissioner of Palestine retains the right to cancel the concession which has been given if, within three years, the Irak Petroleum Company, Ltd., in which British, American, French and Dutch interests are represented, fails to conclude similar agreements with the Governments of Irak and of French Syria and the Lebanon Republic.

The Explosion in Submarine X.1.

ON Tuesday last, February 3rd, about 10.30 a.m., an explosion occurred in the submarine "X 1," which is the largest vessel of her type in the British Navy. The accident happened off the "Edinburgh" light vessel in the Thames Estuary, while the submarine was carrying out trials after a recent refit at Chatham Dockyard. According to the official Admiralty report, she had been proceeding for half-an-hour at full speed when the explosion occurred in the crank case of the port main engine. Its cause, it has been suggested, was the temporary seizure of a piston, which may have ignited oil in the crank case. The explosion was severe enough to injure six men seriously, and to inflict minor burning injuries on some others. Most of the men who suffered were on duty in a compartment abaft the engine-room, in which a large locker was carried away by the force of the explosion. The vessel subsequently returned to Chatham on her starboard engine. Submarine "X 1" was laid down at Chatham Dockyard in 1921, and began her trials in January, 1924. From 1925 onwards she was stationed in the Mediterranean. Her design embodies several new features in both her hull and propelling machinery, and she is reported to be a fine sea boat, with a very small turning circle, and with special capabilities for deep diving. Her length is 350ft., her displacement 2525 to 3600 tons, and her armament four 5·2in. guns and six 21in. torpedo tubes. Her main Diesel engines have a designed output of 6000 B.H.P., corresponding to a speed of 19·5 knots, while her 2600 horse-power motors are designed to give her a speed of about 9 knots when she is submerged.

The Nag Hammadi Barrage.

No. II. (*Conclusion*).*

As is well known, the river Nile comes down in flood annually, and during the period of high water level no work can be executed in the bed of the river. At Nag Hammadi this period extends approximately from the latter part of July to the latter part of November, say, four months, during which time all movable plant and appliances have to be transferred from the river bed and stored on either bank. It will be seen from this that the carrying out of the works was practically a seasonable job, confined to about eight months between the decline of one flood and the rise of the following. A certain quantity of work, however, was executed during the floods, such as the turning of the arches over the openings in the barrage and the construction of the parapets and roadway on the superstructure, which were well above flood level.

The contractors when submitting their tender to the Egyptian Government, offered to complete the works by the end of August, 1930, thus allowing themselves three low water periods of about eight months each for the construction of the lock and the foundations of the barrage with the piers thereon in the bed of the river, and these seasons were termed 1928, 1929, and 1930. The programme laid down for the three low-water seasons' work was as follows:—1928: The whole of the foundations of the lock and the walls thereon to be constructed to half their height, together with the floor, aprons, and piers of the twenty western vents of the barrage. 1929: The floor, aprons, and piers of the next forty vents of the barrage. 1930: The floor aprons and piers of the eastern forty vents of the barrage, together with the eastern abutment. This programme was slightly modified when the work was carried out, as during 1928 the lock walls were built to their full height, and only the western ten vents of the barrage, while provision was made for constructing fifty vents instead of forty during 1929.

For this purpose the contractors had to arrange their scheme of sudds or temporary dams to the best advantage, and in so doing they provided that the eastern end of one season's sudd should overlap the temporary scar end of the foundations, and form a protection against scour during the annual flood. The western ends of the sudds were formed by the masonry guide walls previously referred to. The sudds were constructed of Larssen mild steel piling driven well down into the sandy bed of the river and backed on the inside with limestone rubble. Diaphragms of Larssen piles were also driven beneath the guide walls and the piers of the barrage against which the guide walls abutted so as to form a cut off, the tops of the piles being embedded in the underside of the concrete-in-mass foundations. All the piles were removed when they were no longer required, with the exception of the diaphragm at the guide walls, and most of the limestone rubble was lifted and used where possible in the construction of the permanent works. The approximate outlines of the sudds for each season's work were shown in Fig. 6 in our last issue.

Work on the first season's sudd was commenced early in November, 1927, but on account of the rapid fall of the river, pile driving was discontinued and this sudd was completed with sand bags backed by materials from the excavation, the area being unwatered by the third week in January, 1928. A commencement was made on December 27th, 1927, with the permanent mild steel sheet piling, which surrounded the whole of the foundations of the lock and the guide walls upstream and downstream thereof, and the steel piling in the cut-off beneath the barrage floor, and in the downstream toe was started on March 17th, 1928, and these were all completed by the middle of May, some 2600 tons having been driven.

A small area of the concrete foundations of the lock was laid in January to enable his Majesty King Fouad to lay a foundation stone, which was carried out with great ceremony on February 10th, 1928. The concreting of the lock foundations was commenced on March 17th and completed on May 28th, when work was continued on the floor and aprons of the barrage, on the completion of which the first ten piers of the barrage were put in hand and built to their full height, the walls of the lock being also under construction during this period.

The sudd was cut on July 23rd and the enclosed area flooded, and work for this season ceased in the middle of August. A commencement was made in November, 1928, with the driving of the piles of the second (1929) season's sudd, and this was completed by January 5th, 1929, and unwatered by January 21st. The work to be constructed consisted of fifty vents of the barrage complete, *i.e.*, half its length. Concreting and the rubble masonry were started about the middle of February, and the floor was completed by the end of May. The piers were under construction from the end of March till the middle of July, but some of them were finished after the enclosed area was flooded on June 26th. The contractors had about five months in which to work inside the dam, during which period they excavated 80,000 cubic metres for foundations, drove 3250 tons of mild steel piling and placed in position some 113,000 cubic metres of mass concrete, concrete blocks, dressed ashlar, rubble masonry, &c. The arches over these fifty vents were completed during the flood of 1929, so that, by the time the river dropped, the barrage was practically completed as far as Pier No. 60.

During the 1929 season the lock was dammed off and the lock gates and penstocks were supplied and erected by Sir William Arrol and Co., Ltd., and the lock was officially opened for river traffic early in December, when all navigation was stopped in the eastern channel of the river by the driving of the contractors' piles for the third season's work of 1930. Messrs. Arrol also erected the swing bridge across the lock and Messrs. Ransomes and Rapier erected the two petrol-driven operating machines on top of the barrage and placed the sluice gates in the first ten vents.

The driving of the piles for the third season's (1930) sudd was commenced late in November, 1929, work having been delayed somewhat owing to the unusual height of the flood and the slow fall of the river. The area between Pier No. 60 and the east bank of the river was enclosed by January 11th, 1930, and was dried out by the end of the month. Very little excavation was required, as the river had levelled the foundations to approximately the correct height above datum. Pile driving was started at once, and the whole of this season's piles were nearly completed, and a small quantity of concrete in mass had been deposited in the floor of the barrage when on February 25th a "blow" occurred beneath the sudd at its west end; the sudd collapsed, which allowed the whole of the area to be flooded to the level of the river. Remedial measures were taken in hand at once, so that by March 25th the sudd was repaired and on March 30th the enclosure was again dry and work on the barrage recommenced on March 31st.

A month's time at the most critical season of the year having been lost, the contractors were obliged to work night and day continuously and put on three shifts of eight hours each on the concreting, &c., so that by June 24th all work in the bed of the river was complete, the forty piers and the eastern abutment had been built to their full height and the water was allowed to rise inside the sudd. The following approximate quantities of permanent work handled during the periods February 1st to February 24th and March 31st to June 22nd give some idea of the efforts undertaken by the contractors in order to enable the barrage to be used during the flood of 1930 for irrigation purposes:—

Filling deposited	11,000 metres cube
Permanent mild steel piles driven	4,795 No.
Concrete in mass	41,900 metres cube
Rubble masonry	34,300 metres cube
Granite and limestone ashlar	2,750 metres cube
Granite sills and paving blocks	2,000 metres cube
Concrete blocks	13,700 metres cube
Rubble pitching under blocks	12,750 metres cube

Although the arches over the vents of the 1930 season's work were not completed till early in November and the operating machines not available, all the permanent sluice gates were lowered into position by cranes previous to the arrival of the flood, short lengths of temporary joists and differential blocks being provided for their manipulation. The flood, however, was a poor one, and the gates at the eastern end of the barrage were not worked to any great extent. Regulation was commenced on September 4th, when all the bottom gates were lowered, the Fouadia Canal having been opened on August 25th by the Under-Secretary of State for Public Works. By the adoption of these temporary arrangements for working the gates in the eastern forty vents the basins in the area on the west bank of the river commanded by the barrage received their full supply of water, which would otherwise not have been distributed to them on account of the low and very short flood of 1930, a circumstance which was a great gain financially to the Egyptian Government and the cultivators.

Work on the Fouadia Canal Head Regulator was commenced about November, 1928, and continued intermittently during the 1929 season, being finished and the gates together with the operating machine erected by the end of July, 1930. This regulator consists of six openings, each 6 m. in width and is practically a replica of a portion of the barrage. It supplies a new canal that has been constructed on the west bank of the Nile, which serves the basins down as far as Assiut. When more water is available from the heightened Assuan Dam, or from the proposed Gebel Aulia Dam, in the Sudan, the area served by the Fouadia Canal will probably be put under perennial irrigation.

The Faroukia Canal Head Regulator on the east bank of the river has three openings, each of 6 m., and is again a replica of the barrage design. This work, which was not hurried, but was practically completed at the same time as the barrage, and will supply the Faroukia Canal on the same lines as the Fouadia Canal on the west bank.

These two canals were the subject of separate contracts, quite independent of the contract awarded to Sir John Jackson, Ltd. The canals and the subsidiary works in connection therewith downstream of the head regulators, were designed by Negiul Bey Ibrahim, the Director of Projects and Resident Engineer of the barrage and his staff. Mr. A. R. Ellison was Resident Engineer for the barrage.

We reproduce on pages 151 and 160 and herewith a further series of photographs which have been kindly lent to us by the engineers—Messrs. Coode, Wilson, Mitchell and Vaughan-Lee.

Fig. 13 shows the finish of the foundation work of the 1929 season, taken June 21st, 1929. It will be observed that a portion of this year's sudded area has been flooded, the river water being excluded by the retaining wall at Pier 40. The retaining wall

FIG. 13—FINISH OF FOUNDATION WORK OF 1929 SEASON

FIG. 14—VIEW FROM PIER NO. 60, MAY 13TH, 1930

* No. I. appeared January 30th.

THE NAG HAMMADI BARRAGE ON THE NILE

MESSRS. COODE, WILSON, MITCHELL AND VAUGHAN-LEE, MM. INST. C.E., WESTMINSTER, ENGINEERS

FIG. 15—CONDITION OF WORKS AT END OF 1929 SEASON

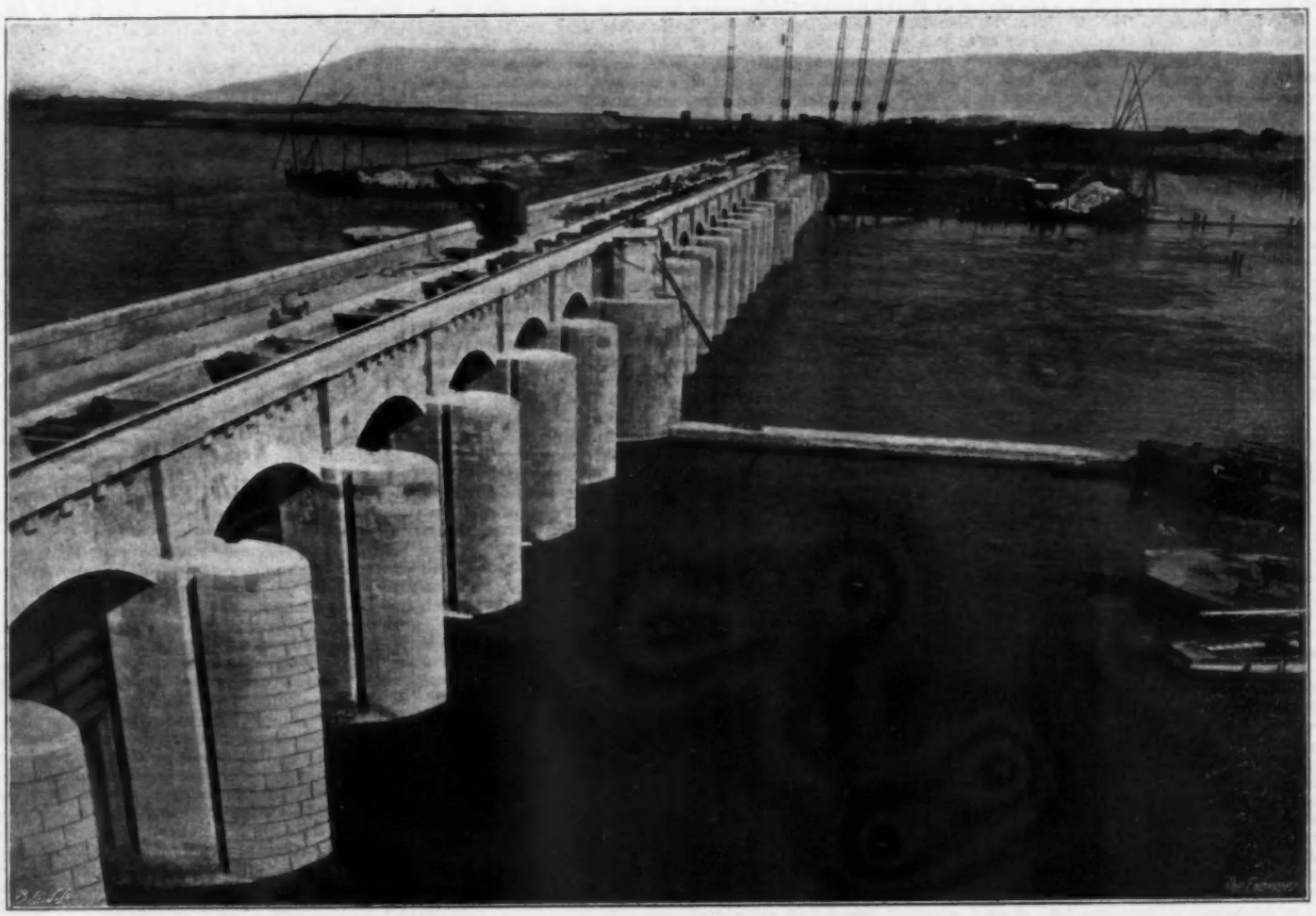


FIG. 16—CONDITION OF WORKS ON FEB. 2ND, 1930

THE NAG HAMMADI BARRAGE—PART OF UPSTREAM FACE

FIG. 17—VIEW SHOWING BLOCKWORK APRON PARTIALLY FLOODED, JUNE 7TH, 1930

at Pier 60 can be seen in the foreground. Fig. 15 shows the barrage at the end of the 1929 season, with the river in flood; work on the arches at Piers 40 to 60 is in progress. Fig. 16 shows the completed work on February 2nd, 1930, from Pier 35 to Pier 60, the temporary dam for the 1930 season's work is seen in the distance, the enclosed area having been unwatered and work on the foundations commenced; some of the permanent sluice gates can be seen. Fig. 14 gives a very good idea of the work in progress during the 1930 season and shows the enormous number of men employed on the different items of work. Fig. 17 shows the upstream side of a portion of the barrage with the upstream blockwork apron partially flooded with water. This photograph was taken in June, 1930, previous to the flooding of the area enlcosed by the sudds. Fig. 18 on page 160 gives a general view of the upstream side of the barrage, showing the lock on the left-hand side. Fig. 19 gives the downstream side of the Fouadia Canal Head Regulator, and shows the water being admitted to the canal on August 25th, 1930. This photograph is also typical of the downstream side of the barrage, and shows the architectural features of both works.

Opportunities for Seaplanes in Burma.

By THEOPHILUS.

BURMA is a land of neglected opportunities. As a mere province of India, it has been overlooked; but the country is large and rich, and the political disabilities under which it has laboured are likely to be removed almost immediately. Separated from India, Burma is going to forge ahead, and it has resources which should quickly bring it abreast of its favoured and already separated neighbours, Ceylon and Malaya. Burma produces rice, timber, tin, rubber, silver, and oil in large quantities. It has an area bigger than that of Germany. The population of slightly over 13 millions, though comparatively small, is largely concentrated in the rich delta lands and in towns up and down the waterways. Lastly, terrestrial communications are at present very bad, and are likely to remain so. There are only 1925 miles of road and 1920 miles of railway. On the other hand, there are almost endless waterways. The opportunity for seaplanes is unique.

It is important to glance at the character of the Burmese and cognate races, upon whose patronage commercial aviation would depend. They are gay and debonair. They are entirely free from that morose temper which makes Indians so difficult and so unsatisfactory to deal with. Not only are they open-minded, progressive, and pleasure-loving, but they are spendthrift to a fault, and are always ready to spend their money on a novelty. These are unusual qualities in the East, and have a commercial significance for those who, in these days, venture capital and industry abroad.

It is quite in keeping with the neglect under which Burma labours as an Indian appendage that she should straightway earn a bad name with trans-continental airmen. She will be the last country under the sun to receive from India the money—Burma's own money—wherewith to make aerodromes. She is anxious to make one in Rangoon, but the revenue is taken away to India. Further, trans-continental flights have to battle with monsoons in the Bay of Bengal, and have to take fearful risks over vast uninhabited areas of swamp and forest. But what has been overlooked is the magnificent river system, which, together with the peculiar grouping of the population, makes Burma ideal for a seaplane service.

The Irrawaddy is navigable for a thousand miles from the sea up to Bhamo, and in the absence of roads, and till recently of railways, this river was Burma's great highway upon which all its towns and villages were situated. The only large towns not on the river are those which have grown up along the railway line. Thus most of the population is near the Irrawaddy. The towns are not very far apart, but in between are innumerable villages the population of which has still the crudest possible means of conveyance by sampan and bullock cart to the nearest river port at which steamers call.

In the delta, the Irrawaddy spreads out into almost uncountable channels, and it is there, on account of the rice cultivation, that the population is most dense. Towns and considerable villages are numerous, and the people possess a good deal of wealth.

All these connected waterways and others to be mentioned, are calm and safe. Large waves are never encountered. In the monsoon there are strong river currents, but there are frequent slack waters, and as far as can be judged a seaplane could alight and take off everywhere.

All this vast country is served almost exclusively by the Irrawaddy Flotilla Company's excellent steamers. The company's reputed wealth is perhaps the best possible proof of the opportunities that exist. The Irrawaddy flotilla gives good service, but distance, of course, imposes certain limitations. A mail steamer takes about nine days to travel the five or six hundred miles from Rangoon to Mandalay. The railway train does the journey in 18 hours, but it is far from the river and there are hundreds of important riverine places which are a week's journey, or at least four or five days' journey, from any centre.

In all these areas the climate is regular. The winter is brilliant, with winds flowing south to the sea. The monsoon is cloudy with much rain, especially in the delta, but the winds are mostly steady, flowing north from the sea. There are occasional storms, but little dust, and none of that violent turmoil that occurs out in the Bay of Bengal. There is no mist, and no fog except in winter in the very early morning. It invariably disappears after 10 a.m.

In Upper Burma the conditions are somewhat different. There also there are magnificent waterways, namely, the Irrawaddy and Chindwin rivers, which are also served by the Irrawaddy flotilla. But the distances are greater, and the population is less numerous and less wealthy. Nevertheless, Upper Burma offers great opportunities. The weekly mail and cargo steamers take the best part of a week to sail from Mandalay up to Bhamo. They take a full week to ascend the Chindwin from Monywa to Homalin. The Chindwin possesses some spectacular whirlpools during the rains, but otherwise it is a placid river, and a very beautiful one. As a compensation for distances, there are Government mail contracts, which a regular air service could hardly fail to secure.

Nor would services be limited strictly to the river. Both at the summer capital of Maymyo and at the ruby mines of Mogok, there are extensive lakes where seaplanes could alight. From Mandalay on the river to Maymyo, the summer capital in the hills, is perhaps 40 miles—by air less—and from the river to Mogok is 60 miles by road. Similar opportunities would reveal themselves elsewhere, such as at Myitkyina—railhead—in the far north, where the Irrawaddy—above the "defile"—opens out into placid water again. The Chindwin is more or less parallel to the Irrawaddy, and at no great distance from it; and by finding a chain of swamps and lakes, for emergency landings, it might be cheaper to serve all the Chindwin towns from a depôt on the Irrawaddy.

The opportunities are limitless, and this rich fruit only awaits an enterprising hand to pluck it. It would only be necessary to decide upon the scale of the undertaking—whether it should be local to Upper or to Lower Burma, or whether it should embrace the whole country; whether the service should be

only between fixed points, or whether it should cater also for local or inter-town taxi service. The sites of depôts and repair sheds and of accommodation for staff would have to be selected.

It is essential that a service of this magnitude should have capital and influence behind it, and that it should be first-class. An air service which is to gain public support and confidence must not be run on the cheap, like most of the local motor car services, with reckless drivers, and with a pitiful misuse of machinery which runs till string will no longer hold the parts together. The Irrawaddy Air Flotilla could not afford to be anything but up to date, and the free-handed, spendthrift character of the people justifies good service. In Burma money is not made to be buried. It is made to be spent—as quickly as possible—and if a man, or a clear-headed Burmese business woman, could go by air from one point to another for a sum not altogether disproportionate to the fare by rail, steamer or bullock cart, he or she would certainly go by air.

Air transport in such an undeveloped country has many advantages over other forms of transport, and the most significant is that it cuts out all the "incidental expenses"—food, porters, carts, rest-house bills—which all add so enormously to the cost of travel. The actual fare is only one item when a short journey takes a long time. Take, for instance, the journey from Mogok to Mandalay. The actual steamer fare is only Rs. 12·8·0—first class. But there is the motor car—Rs. 35, or by bus Rs. 3—porters at the river, rest-house fees, a day's feeding—or upstream a day and a-half's feeding, plus, perhaps, Rs. 5 for the convenience of sleeping on board—then more porter charges. A traveller will be extremely lucky if he does the journey on Rs. 50, of which the steamer fare is only Rs. 12. A seaplane completing the same journey in just a few hours could surely have little difficulty in fixing an attractive price.

It is an axiom of terrestrial transport services that first-class passengers do not pay. It is the third-class passengers who are the source of profit, and any air service in the East—and especially in Burma—should cater first and foremost for the poor man. It is submitted that the conditions described above render it possible to do so. Possibly, the writer has failed to make clear the overwhelming difference in character between Aryan Indians and the Mongolian Burmese. The one clutches his halfpence, hoards them, buries them. The other squanders his money recklessly to the despair of his friends, lest he should have the misfortune to die without having had his fun. You cannot take your money hence, so why ride in a bus if you can get a taxi? This attitude may be incredibly shortsighted, but it is mentioned here as an existing fact.

At present aviation in the East seems to concentrate on long-distance projects, which involve tremendous financial and political problems. Local service has received very little attention, indeed. Aviation is shortly to be taught in Rangoon by a private individual, but behind such a project as we have suggested there needs to be more capital and more organisation and security than any small local company could provide. Security, above all, is required. A rattle-trap concern, which dropped passengers into the muddy waters of the Irrawaddy, would not meet the case; nor can airmen be picked up like motor drivers on the street, and the best hoped-for of their ignorance and recklessness.

Railways are suffering everywhere in the East from motor bus competition. But river service—at least, in Burma—flourishes. Moreover, Burma, the milch-cow of India, is to enter upon a separate existence in the immediate future. Even if Burma is not actually separated, she will certainly attain financial ameliorations which will amount to very much the same thing. Less money will be contributed to India. More will be spent locally. Trade will increase and taxation will decline. Burma, the despised Cinderella, has found her fairy godfather in Sir John Simon, and fortunate will be he who shall first woo her.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

DIESEL.

SIR,—In an article on pages 681–82 of your issue of December 19th, 1930, the suggestion is made to restrict the designation "diesel" to heavy-oil engines using air-blast fuel injection.

In view of the facts recalled below, this suggestion appears to me to be somewhat inappropriate.

Rudolf Diesel's major purpose was not to develop a particular kind of mechanism for his fuel admission, but to produce a heat engine the cycle of which approximated, as far as practicable, to that of maximum thermal efficiency—the Carnot cycle.

This is evident from the well-known claim in his German patent 67,207 of 1892: "Working process for internal combustion engines, characterised by the feature that in a cylinder charged by piston suction with pure air or a mixture of air and indifferent gas, the piston so highly compresses said air that the resulting temperature greatly exceeds the ignition temperature of the fuel, whereon said fuel is so fed from dead centre onward, that combustion, by reason of piston displacement and resultant expansion, takes place without appreciable rise in pressure and temperature, to be followed, after termination of fuel admission, by further expansion of the gases."

Diesel was, as far as I am aware, the first to substantially accomplish this. His was the deed.

In Diesel's treatise "Theorie und Konstruktion eines rationellen Waermemotors zum Ersatz der Dampfmaschine," published by Springer, 1893, in which he expounds his purpose, I find no mention of air-blast injection. When using powdered coal, the method of admission, given on page 62, is: "The flow of powder takes place gradually and uninterruptedly during the prescribed travel of the piston, and is similar to that of sand in an hour-glass . . ." The mechanism is shown in Figs. 3–12. The method, when using liquid fuel, is mechanical injection, and reference to page 75 reveals the following:—"The nozzle D, which is closed by the needle *n*, effects the gradual and uninterrupted admission of fluid combustible; the fluid combustible is supplied through the inner space *r* of the nozzle D—Figs. 13 and 13A—by a feed pump—not shown—under constant superpressure—*Ueberdruck*—the pipe connection *t* from the pump is shown in Fig. 14."

Then, further on, same page: "An annular space S around the nozzle is shown in Figs. 13 and 13A. This is open to the interior of the cylinder. As the pressure decreases during the travel of the piston, the air rushes from this space into the cylinder and serves in this wise to spray the combustible jet and also to produce turbulence—*zum Hervorrufen stuermischer Bewegungen*—in order to distribute the heat of combustion throughout the whole air volume. This annular space S has solely practical significance, and is of no importance to the process proper."

We know that Diesel had no success with these or similar ancillaries, and the difficulties of the problem of mechanical injection, only comparatively recently fully overcome, compelled him to search for other means. This led to air-blast injection as an expedient, and to ultimate success in 1897.

In view of the above, it surely would be unsatisfactory to limit the term "diesel" to engines using air-blast fuel injection.

I was among those to whom Rudolf Diesel demonstrated his engine in Augsburg in 1898. He invited us to make our own tests. He did not lay stress on air-blast injection as an object of achievement, but on the attainment of thermal efficiencies hitherto unknown. Incidentally, I recall his enthusiasm regarding the future of his engine and his prophecy that it was destined to propel the ships on the seas.

An internal combustion engine working substantially in conformity with the claim cited above is known the world over as a diesel engine. If a name must be used, what other designation would be preferable?

Moreover, the term "diesel" is now spelt with a small *dee*, is entirely impersonal and, in its accepted meaning, to the point. ERIC BROWN.

Baden, January 28th.

[The air-blast differentiates between the Akroyd, solid injection, engine and the Diesel. For solid injection Diesel had no claim to priority.—ED. THE E.]

THE "ROCKETS."

SIR,—I should like to offer a few observations on the points that have been raised in this correspondence, more especially in the well-reasoned but slenderly founded account by Mr. Holcroft in his recent letter. Mr. Dendy Marshall's reference to the drawing of the "'Rocket' transformation" in Deghilage might add to the mystery were it not for the fact that its origin is disclosed in the descriptive matter which is quoted from THE ENGINEER. Deghilage's beautiful work was published in 1886, and he was doubtless well informed as to what was going on in the British engineering Press, and so impressed by the tenor of the correspondence about the "Rocket" of a year or two previously that he made up a drawing from Stenson's touched-up sketch—*croquis relevé*—and included it. Mr. Dendy Marshall does not say, as Mr. Holcroft writes, that Deghilage saw the engine at Leicester, neither does the latter state so. The Stenson alluded to is evidently William Stenson, an engineer, well known in Derbyshire, who took the earliest initiative in the formation of the Leicester and Swannington line. In this I quote from F. S. Williams' "Midland Railway." May I point out that Clement Stretton does not state that "Comet" was No. 4 on the company's list, but on the makers'—Stephenson's—list. In both editions, 1892, 1896, of his "Locomotive Development," he describes the "Comet" in detail—that the piston-rods passed under the leading axle, the valves placed on the tops of the cylinders, with a variety of other particulars. A sketch of the engine is given. He states, too, that the chimney was 13ft. in height, and was subsequently reduced to 12ft. 6in. In both editions a folding sheet is included, being a copy of the official list of the first ten engines commencing with "Comet"—railway company's No. 1. The list embodies copious dimensions, and is signed at the foot "John Nicholson, Engine Superintendent, Engine Superintendent's Office, Leicester, 1839." The date at head is 1832–1839. Under the heading of "Remarks," it is stated "Comet sent to London and Birmingham co., December, 1836." Length of boiler barrel is given 7ft. 1¼in. and width of fire-box 3ft. 5in., which are both greater than the dimensions given by Mr. Holcroft of the "1930 Rocket." It is agreed, I think, that there was no more than one "Comet" on the Leicester and Swannington, and if this had been an outside-cylinder engine, as is suggested, it is difficult—in fact, well-nigh impossible—to imagine that Stretton, who so jealously guarded all historical matters concerning the L. and S., would have specifically described it as an inside-cylinder locomotive. Living on the spot as he did, he must have been acquainted with many of the old employees of the company, and had access to the old documents available. Had he attached importance to the correspondence in the *English Mechanic*, he would surely have made some reference to it in his history.

With regard to James Nasmyth. In Smiles' Preface to the Autobiography, published in 1883, it is stated that Mr. Nasmyth commenced to write his recollections "during the last two years." His references to the "Rocket," pages 156–7, were made therefore approximately fifty-one years after the event. I venture to say that, however well preserved a man is, memory is liable to play pranks in regard to happenings half a century old. He relates that he saw the "famous Rocket" make several short trips driven by George Stephenson, with his son acting as stoker. Now, is it not more probable that Stephenson would have been testing his latest engine, the "Northumbrian," which a day or two afterwards was to be engaged in the most important task of drawing the "costly and splendid car" conveying the Duke of Wellington and his *entourage* in the opening procession? I suggest that George Stephenson and his son would much more likely have been doing this, seeing that G.S. was to be in charge of the "Northumbrian" at the head of the procession on the opening day, than to have been driving the "famous Rocket," which was to be in the fourth place. It appears certain that it was the "Northumbrian" that Nasmyth sketched, to which the name plate may not then have been affixed, and that he at some later period added "Rocket" underneath the drawing without giving the matter due thought. "Rocket" would have been the name uppermost in the minds of people in those days in connection with locomotives, as it is still now almost, and the oversight on his part, meticulous as he was, would not have been unnatural after a lapse of some time. Nasmyth further states: "The line was opened on the 15th of September when the famous 'Rocket' led the way." This is an instance of inaccurate recollection.

The chimney stays of the "Northumbrian" present a problem, but as I understand Mr. Dendy Marshall to infer, they may have been used at first experimentally and afterwards discarded. I have not had an opportunity yet to see the *English Mechanic* of 1884–5, with the letters that have given rise to the present discussion, but those from which extracts have been quoted are curious, inasmuch as they are clothed in anonymity.

My remarks are not intended to explain the mystery, if one exists, of the "Rockets." The interpretations of some relative matters I put forward may help to elucidate certain points that hitherto have been regarded as obscure.

A. M. H. SOLOMON.

London, N.W. 6, January 28th.

SIR,—In continuation of my letter of last week, the following points are, I think, of interest. The drawing of the 0–4–2 engine given by Mr. Warren is dated October, 1832; it is therefore unlikely to represent the "Comet," since the L. and S. Railway was opened on July 17th.

It appears from Stretton's "History of the Midland Railway" that William Stenson was one of the partners in the Whitwick Colliery, and a promoter of the L. and S. line.

A search has been made for the plate, which Dr. Glaisher showed me some twenty years ago, but unfortunately it cannot be found. C. F. DENDY MARSHALL.

Guildford, February 1st.

SIR,—I have been following Mr. Dendy Marshall's and Mr. Holcroft's most interesting letters in connection with the "Mythical Rocket." Mr. Holcroft's last letter is most convincing that there was a "Rocket No. 2" on the line round about the opening ceremony of the Liverpool and Manchester Railway.

When the original "Rocket" ran at Rainhill trials she had weight and lever safety valves, as indicated in the reproduction of Rastrick's pocket book, page 162 of Mr. Dendy Marshall's "Centenary of the Liverpool and Manchester Railway." On page 81 of that book, Nasmyth's drawing of the "Rocket" as she was a day or two prior to the opening showed Timothy Hackworth's direct coach spring-loaded safety valve between the chimney stays and a spiral spring lever loaded safety valve on the top of the fire-box. It has been suggested that Nasmyth sketched the "Northumbrian" for the "Rocket," but I confess I cannot appreciate this. No drawings that I have seen have shown the "Northumbrian" with chimney stays. On the assumption that there was a "Rocket No. 2," Mr. Holcroft's reference to this engine having the largest cylinders of any produced up to that time by Stephenson and Co. suggests that there was more oscillation and vibration than had been present on any engine previously, and hence the chimney staying. I understand that Nasmyth, as an artist, was most particular in details, and this prevents my believing that he sketched the "Northumbrian" and called it the "Rocket." This leaves the only alternative that the original "Rocket" was renovated. It would of course be early found that oscillation and vibration were prohibitive to the use of deadweight safety valves. The "Sans Pareil" had a coach spring lever loaded safety valve and the "Novelty" what appears to have been a combination of deadweight and spring lever loaded safety valve. The original "Rocket" could have had modified safety valves fitted, but I do not think they would have been brought right up

to date just prior to the opening, whatever may have happened afterwards, because, on page 209 of "A Century of Locomotive Building," it says: "Rapidly increasing demands soon rendered the 'Rocket' too out of date for the traffic of the Liverpool and Manchester Railway, and there is evidence that she was employed principally on the ballasting and other work in connection with the road for which George Stephenson had recommended her immediately after the trials"—Liverpool and Manchester railway director s Minute, October 19th, 1829.

Probably "Rocket No. 1" was discreetly kept out of the road round about the opening ceremony. Obviously, as Mr. Holcroft says in his letter in your issue of 23rd, the public would expect the victor of Rainhill to play a leading part.

DONALD MACNICOLL.

Glasgow, January 30th.

SIR,—The thanks of your readers are, I consider, due to Mr. H. Holcroft for having brought to their notice the story of the two "Rockets."

In his well-known book, "The Locomotive Engine and its Development," the late Mr. C. E. Stretton published a list of the Leicester and Swannington Railway engines, 1832–39. This list, the original of which was signed by John Nicholson, engine superintendent, and dated Leicester, September, 1839, gives "Comet" as No. 1 in the books of the railway company and as No. 4 in those of the makers, Messrs. R. Stephenson and Co. The date on which this engine was delivered "in steam" is stated to have been May 5th, 1832, whereas the delivery date of the "Comet" in the list compiled by Mr. Ashley Bagster—*vide* Mr. Holcroft's letter, page 101, of your issue for January 23rd—is given as March 3rd, 1832. Moreover, the "Comet" in Nicholson's list had, according to Mr. Stretton, inside cylinders, while that in Bagster's document had oblique outside cylinders.

The following particulars are taken respectively from Mr. Stretton's book and from Mr. Holcroft's letter:—

John Nicholson's List: Leicester and Swannington Railway Engines.

No.	Name.	Maker.	Date delivered.
1	"Comet"	R. Stephenson and Co.	May 5th, 1832
2	"Phœnix"	Ditto	Aug. 28th, 1832
3	"Samson"	Ditto	Jan. 1st, 1833
4	"Goliath"	Ditto	Mar. 20th, 1833
5	"Hercules"	Ditto	Dec. 17th, 1833
6	"Atlas"	Ditto	Feb. 8th, 1834
7	"Liverpool"	Edward Bury	July, 1834
8	"Vulcan"	Tayleur and Co.	Apl. 2nd, 1835
9	"Ajax"	Haigh Foundry Co.	Oct., 1837

Ashley Bagster's List: Leicester and Swannington Railway Engines.

No.	Name.	Maker.	Date delivered.
1	"Comet"	R. Stephenson and Co.	Mar. 10th, 1832
2	"Phœnix"	Ditto	July 1st, 1832
3	"Samson"	Ditto	July 22nd, 1832
4	"Goliath"	Ditto	July 10th, 1832
5	"Hercules"	Ditto	Mar. 20th, 1833
6	"Ajax"	Haigh Foundry Co.	Jan. 1st, 1835
7	"Vulcan"	Tayleur and Co.	July 10th, 1835
8	"Atlas"	R. Stephenson and Co.	June 17th, 1835

It will be noticed that the dates of delivery, as between the two lists, do not agree. Neither do the numbers and names of the engines correspond after No. 5, "Hercules." Again, No. 7, "Liverpool," cited in Nicholson's list, does not appear at all in Bagster's statement. These various discrepancies, in what may be regarded as historic records, are somewhat puzzling.

F. W. BREWER.

Stevenage, Herts., January 31st.

SIR,—The illustration of the Swannington engine produced by Mr. Dendy Marshall agrees with the particulars which I have already supplied as regards its outline, and so far nothing has been brought forward to shake my belief in the brief appearance of this second "Rocket" on the L. and M. Railway in 1830.

The absence of any mention of this engine in R. Stephenson and Co's ledger of 1823–31 does not constitute the difficulty, or even fatal objection, to my claims that Mr. Dendy Marshall would make out. In the first place, the ledger represents the business transactions of the firm, and it is not necessarily a complete record of shop construction. Secondly, the engine was not paid for until January, 1832, and an entry should be recorded in the ledger for 1832 onwards. Can this be found?

February 2nd. H. HOLCROFT.

WELDED BOILER DRUMS.

SIR,—We have learnt with the greatest interest that recently the U.S. Navy have issued orders for boilers which are to be fitted with welded drums. These boilers are for use on the new scout cruisers "Minneapolis," "New Orleans" and "Astoria," and will be supplied by the Babcock and Wilcox Company.

Some of us have recommended this type of construction for use in this country for some years, but, so far, it appears that although welding is accepted for almost all other pressure work in this country, boiler drums are, so far, excluded. It is, of course, known that welded drums have been used extensively on the Continent for pressures up to 800 lb. per square inch, and from a list recently published by one of the big German manufacturers, it is noted that the Hanomag Company, of Hanover, have ordered and supplied welded drums for pressures up to 675 lb. per square inch. Again, the Buttnerwerke, of Urdingen, have supplied welded drums up to a pressure of 855 lb. per square inch. The Oberhausen works of Messrs. Babcock and Wilcox have supplied many welded drums for pressures up to 600 lb. per square inch.

As far as the writer has been able to ascertain, no trouble has yet been experienced with this form of construction.

Riveting of boiler drums has been handed down from the early days of steam practice when it was originally used for low pressures. For these conditions riveting formed a convenient method of joining plates. In these days, however, when the tendency is towards high pressures, the use of riveted joints for boiler drums is open to a great deal of criticism.

In this country we are restricted to two types of manufacture, namely, the riveted drum and the solid forged drum, and from a commercial basis it is felt that the use of the forged drum is not justified until one reaches pressures of 650 lb. per square inch or over. On the other hand, the limits placed on riveted construction is open to a great deal of discussion, but, undoubtedly, over pressures of 400 lb. to 450 lb. per square inch the use of this method is open to doubt. The writer feels, therefore, that between the pressures of 400 lb. per square inch to 650 lb. per square inch, the introduction of welded drums would satisfy a long-felt want in this country, where, at the present moment, the majority of power stations are being designed for pressures bordering between these two figures, and, undoubtedly, engineers are being driven to accept the lower pressures rather than face the outlay of forged drums. It is understood that the tonnage price of welded drums, as manufactured on the Continent, is very little more than drums of riveted construction.

The writer feels that a firm of the high standing of Messrs. Babcock and Wilcox are to be congratulated on the stand they have made in other countries for this modern advancement. In America they have conducted very keen research work into this problem. It means no small commercial courage for a firm to face this problem when they are equipped with very expensive plant for the manufacture of riveted drums, the usefulness of which falls away when welded drums become accepted.

From recent publications, it is known that the English authorities now approve of the use of hammer welded drums in preference to other forms of welding for high pressure containers intended for the storing of poison gas. It is to be hoped, therefore, that their investigations will embrace the use of such vessels for boiler drums.

One feels also that engineers who are responsible for the laying down of our big power stations would do well to consider the welded construction, because, if the same can be introduced, the whole fieldof boiler-making is opened up and, what is equally important at this stage of our industrial life, a new industry will be founded for this country.

COMBUSTION STEAM GENERATOR, Ltd.,
P. W. MCGUIRE, General Manager.

London, January 30th.

B.E.S.A. Specifications.

INDEX TO BRITISH STANDARD SPECIFICATIONS.

The 1931 edition of the Index to British Standard Specifications has just been issued. It is a complete subject index, which, in view of the large number—410—of British standard specifications now available, some of which include provisions for several articles or materials, will be of much assistance to those purchasing engineering and allied material apparatus and machinery. A numerical list of the specifications is also included. The list, which covers 38 pages, shows the wide range of subjects covered by the British standard specifications and should be in the hands of all drawing-offices and contracts departments of firms throughout the engineering and allied authorities who have found the British standards of such benefit in the preparation of contracts.

Copies are available from the Publications Department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 1s. 2d. post free.

PERMANENT MAGNETS.

A specification just issued by the British Engineering Standards Association is the result of over ten years' work, has involved a considerable amount of research, and deals with the essential details of the construction and the working of apparatus suitable for use in workshops for the testing of permanent magnets of uniform cross section, suitable for magneto generators, and of other magnets the dimensions of which are within specified limits. The instruments covered by the specification are particularly designed for the rapid determination of the permanence, coercive force, and the maximum value of the product $B \times H$. They are arranged to give a direct indication of these quantities for any length or cross-sectional area of magnet within certain limits, and, if desired, the full hysteresis loop may be plotted. Two types of apparatus are described in the specification, differing essentially in the type of flux meter used. Both types are considered equally suitable for the practical measurement of the quantities referred to above. These two types—A and B—differ in that type A employs a pivoted moving coil carrying a known current and swinging in the field of the magnet under test; whereas type B employs a rotating disc driven at a known speed and in the field of the magnet under test, the induced electromotive force being measured by a millivoltmeter. The readings obtained from both types of apparatus are subject to certain errors, corrections for which may be applied and for which detailed directions are given in the specification.

SHIPS' CARGO-LIFTING BLOCKS.

A British standard specification for Ships' Cargo-lifting Blocks—No. 408, 1931—has just been issued. The work of preparing it was carried out by a Committee of makers and users in collaboration with the Home Office. It lays down requirements as to the materials from which the various parts of the block should be made, gives details as to workmanship and manufacture, prescribes the test loads to which blocks are to be submitted, and makes recommendations as to the sizes of sheaves for use with wire ropes made in accordance with B.S. Specification No. 365.

One of the most important matters covered by the specification, however, is the inclusion of a standard definition for the safe working load of a given block, together with particulars of a standard method of marking blocks indicating the maximum safe working load for which they may be used.

Copies of these specifications, Nos. 406 and 408, 1931, may be obtained on application to the British Engineering Standards Association, Publications Department, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

THE INSTITUTE OF METALS.

As previously announced, the twenty-third annual general meeting of the Institute of Metals will be held, by permission, in the Hall of the Institution of Mechanical Engineers, Storey's Gate, London, S.W. 1, on Wednesday and Thursday, March 11th and 12th. The following programme of the meeting has been arranged:—

On the Wednesday, at 10 a.m., the reports of the Council and the Honorary Treasurer will be presented, and papers will be introduced and discussed. The meeting will be continued during the afternoon. The annual dinner and dance will be held at the Trocadero Restaurant—Empire Rooms—Piccadilly Circus, W. 1, at 7 p.m. On the Thursday the meeting will be continued and concluded. The following papers are expected to be submitted:—Messrs. S. L. Archbutt and W. E. Prytherch, "Investigation of the Effect of Impurities on Copper: Part VII., The Effect of Antimony; Part VIII., the Combined Effect of Antimony and Arsenic." Mr. L. J. Brice, "Some Properties of Silicon-Aluminium Bronzes." Captain William E. Collins, "The Corrosion of Early Chinese Bronzes." Dr. P. J. Durrant, "The Constitution of the Cadmium-rich Alloys of the System Cadmium-Silver." Dr. C. F. Elam, "An Investigation of the Microstructures of Fourteen Silver Greek Coins—500–300 B.C.—and Some Forgeries." Mr. Owen W. Ellis, "The Rolling of Alloys of Copper and Phosphorus containing up to 5 per Cent. of Phosphorus." Dr. H. J. Gough and Mr. H. L. Cox, "The Mode of Deformation of a Single Crystal of Silver." Messrs. J. D. Grogan and D. Clayton, "Dimensional Stability of Heat-treated Aluminium Alloys." Professor D. Hanson, "The Flow of Aluminium at Elevated Temperatures." Messrs. T. P. Hoar and R. K. Rowntree, "A Note on the Silver-rich Aluminium-Silver Alloys Above 600 deg. Cent." Dr. C. H. M. Jenkins, "Some Properties of Metallic Cadmium." Dr.-Ing. K. L. Meissner, "The Effect of Artificial Ageing upon the Resistance of Super-duralumin to Corrosion by Sea-water." Mr. C. E. Pearson and Dr. J. A. Smythe, "The Influence of Pressure and Temperature on the Extrusion of Metals"; and Dr. D. Stockdale, "The Solid Solutions of the Copper-silver System."

The annual May lecture will be delivered on Wednesday, May 6th, by Mr. W. B. Woodhouse, of the Yorkshire Electric Power Company. It will deal with technical and economic progress in the generation of electric power on a large scale.

The Council has accepted an invitation to hold the Annual Autumn Meeting in Zürich from September 13th to 16th. The meeting will immediately follow the Zürich meeting of the New International Association for Testing Materials, to be held on September 6th to 11th.

INVENTIONS AT BUENOS AIRES EXHIBITION.

IN our issue of January 23rd, we published an official statement that the Argentine Provisional Government had issued a decree under which all British patented inventions and designs registered by exhibitors at the British Empire Exhibition in Buenos Aires would be automatically protected in the Argentine Republic from the date of the decree until three *years* after the closing of the Exhibition. It now appears that the terms of the decree had been wrongly transmitted, and that the automatic protection extends for only three *months* after the closing of the Exhibition. The time is so short as to be of relatively little value, and if the Argentine Provisional Government cannot be persuaded to extend it, manufacturers exhibiting patentable inventions will be well advised to take prompt steps to secure protection.

L. & N.E. RLY. COMPOUND HIGH-PRESSURE LOCOMOTIVE.

THROUGH the courtesy of Mr. H. N. Gresley, we are able to give as a Supplement to-day a two-page drawing showing the general arrangement of his four-cylinder compound locomotive, "No. 10,000." Cross sections of the engine appear on page 164. The engine was described at some length in our annual article of January 3rd, 1930, but a more complete account of it is given in Mr. Gresley's own paper read before the Institution of Mechanical Engineers in London on January 23rd, and reprinted in our last and in the current issues.

DURING the September quarter of 1930 the imports of electrical equipment into New Zealand had a total value of £485,646. Of this, the United Kingdom was responsible for £277,318, the U.S.A. for £114,857, Canada for £35,331, and Australia for £12,309. In the corresponding three months of 1929 the imports were as follows:—Total, £484,636; United Kingdom, £244,394; U.S.A., £145,245; Canada, £42,123; and Australia, £13,887.

Industry and Economics.

By J. S. HECHT.*

THAT British industries, and not least the engineering industry, are vitally affected by economic policy is undeniable. It is equally undeniable that comparatively few engineers take a serious interest in political economy. And it is for this very reason perhaps that what is once more undeniable, no solution has been found for any of our industrial problems. Though they originated a hundred years ago, it may be that they remain unsolved because scientifically trained minds have held aloof from economics.

Among the problems which concern every industry is that of Free Trade *versus* Safeguarding. In his approach thereto a scientist would seek to determine the advantages of foreign trade, not to a particular industry or to individuals, but to all industries or a nation as a whole.

Countries differ in their natural physical productive resources. It is impossible, or it would at least be very difficult, and involve an excessive amount of labour, to grow in England rubber, cotton, silk, tobacco, &c., or to produce a variety of food and drink, such as rice, bananas, oranges, lemons, raisins, currents, wine, tea, coffee, and cocoa. Instead of attempting to do so, therefore, Great Britain increases her production of other goods and exchanges the surplus beyond her home consumption for foreign goods. Imports of this description provide an addition to home consumption, and are complementary to home production. The advantage of complementary imports lies in economising labour, and in increasing at the same time the national output.

Until the end of the eighteenth century, international commerce consisted chiefly of an interchange of complementary goods. But with the advent of a practical steam engine, with the development of industry coupled with the provision of cheap, reliable and rapid transport, countries came to import commodities of a kind they were actually producing or could readily produce for themselves. In the middle of the nineteenth century Great Britain began to import her staple food, and towards the end of the century she was importing a mass of manufactured articles. To-day, 75 per cent. of her essential foodstuffs comes from overseas, while her importation of goods wholly or mainly manufactured exceeds £300,000,000 per annum. What, then, is the influence of such imports—competitive imports, because they compete with home production and with the consumption of home products—upon the national output?

According to the current law of international trade, competitive imports cannot diminish the national output. Imports must be paid for by exports or services, so that any contraction in the output of an industry supplying the home market is necessarily offset by an expansion in the output of an export industry. And so it would be if the competitive imports which entered a country were constant in quantity. For example, if Great Britain regularly imported all the iron girders consumed at home, British steel manufacturers could devote themselves to alternative products, or some other industry could augment its output in order to provide the exports to pay for these girders.

As a matter of fact, however, the quantity of competitive imports which enters a country is exceedingly variable. It depends on the relation between home and foreign prices, a relation which changes from year to year, from week to week, from day to day, and almost from hour to hour. Even if home prices were stable, those of the foreigner for export may well be unstable. His prices vary not only with his cost of production, but with his home consumption, while the rate at which foreign monies are exchanged for the pound sterling has a direct influence on the relation between British and foreign prices.

But if the price of, say, German steel falls, the import of German steel increases, with the result that some British steel workers are thrown out of employment. The same thing occurs in all industries subject to foreign competition. According, again, to another economic law—the law of supply and demand—this is immaterial. The labour displaced will immediately find an alternative employment.

Unfortunately for validity of this law, only unskilled manual labourers can change their occupation at a moment's notice. Skilled workmen become proficient at one kind of work, and the more they specialise, the less fitted are they for a different kind of work. Moreover, even if workmen could change their employment, the capital, on which they depend for employment, cannot do so. Plant, machinery, tools, &c., are designed for a specific purpose, and are generally unsuitable for any other purpose. A shipyard cannot furnish typewriters, or a boot factory trousers. In short, notwithstanding that the transferability of labour and the transferability of capital have been described as a postulate of political economy, neither labour, except the most unskilled labour, nor capital can be readily transferred from one industry to another. Consequently, although imports are paid for by exports, competitive imports inevitably provoke unemployment. They are then paid for out of capital, and diminish the national output by destroying the stability of home industries.

Every country's industries include agriculture, and the stability of this industry is perpetually menaced by an instability of a different order—the instability of harvests. When a country has a bad harvest, another country may have a good one, and even when a country has a good harvest some other country may have a better. In, say, five years out of six, therefore, the foreigner will have a surplus for dumping. In five years out of six, British farmers cannot find a market for some of their produce, whether their harvest is good or bad. One might recall the year 1922. Great Britain had a wonderful potato crop, but instead of being consumed, it was left to rot owing to importation from Denmark and Holland. And in the following year the acreage devoted to potato growing in Great Britain was reduced by 17 per cent. Here, then, is the explanation of England's agricultural decadence. Competitive imports diminish the national output by destroying the stability of agriculture.

A stable market is the first requirement of an industry. Its efficiency is also dependent, however, on a large market. Every manufacturer knows that the cost of producing any article varies with the output, and that the cost per article falls as the output grows, more especially with the modern system of mass production. By expending vast sums on research and by installing expensive plant and machinery, production costs can be cut down enormously and overhead charges are simultaneously reduced.

This decrease in the cost of production is not the same in all industries. It is particularly noticeable in the manufacture of highly finished articles and in the technical industries. Trebling the output of motor cars, for instance, would reduce the cost per car by far more than trebling the output of matches would reduce the cost per match. But if foreign manufacturers with a protected home market enjoy, in addition, admission into the British market, British manufacturers are at a hopeless disadvantage in respect of mass production. One need only cite the huge importation of foreign motor cars, notwithstanding the imposition of a tariff of 33 per cent., and the world-wide export of American manufactures notwithstanding the high wages ruling in the U.S.A.

Foreign competition, both in the home market and in export markets, is naturally most severe, therefore, in mass-production industries. Labour and capital are driven from industries in which a higher efficiency is attainable through mass production into industries in which mass production has a less appreciable effect. Consequently, although imports are paid for by exports, competitive imports diminish the national output by reducing the efficiency of home industries.

Some industries are not only more susceptible than others to the benefits of mass production, but they are more profitable to both labour and capital. That is, they yield higher wages and/or bigger dividends. This fact is confirmed by the Census of Production, in which it is shown how greatly the annual net yield per worker varies from one industry to another. And the most profitable industries are again those concerned with highly finished articles or technical products, the reason being that in their manufacture there is more call for skill, whether of hand or of head. To provide raw materials or low-grade goods as common textiles, is largely a matter of unskilled manual labour, which less developed peoples can perform.

But the higher are wages and profits in any industry, the more opportunity is there for price-cutting, be it by a reduction in wages or the acceptance of a smaller margin of profit. Just, therefore, as competition is generally most acute in a trade where profits are highest, so is foreign competition, both in the home market and in export markets, likely to be more severe the more profitable an industry. And as labour and capital, given the choice of two employments, would naturally choose the better, when foreign competition forces them out of their employment they are obliged to put up with a worse employment. Consequently, although imports are paid for by exports, competitive imports diminish the national output by lowering the quality of home industries.

The conclusion that complementary imports increase the national output, but that competitive imports decrease it by destroying the stability, reducing the efficiency, and lowering the quality of home industries, is so inevitable to a scientific investigator, that the advocacy of a Free Trade policy seems almost inexplicable. The explanation is that economists and politicians approach the fiscal controversy from a wrong angle. The loss to a people as a whole through a diminution in the country's output is disregarded. Attention is focussed on the benefit to an individual through buying cheaper foreign goods. To every buyer, however, there is always a seller, to every consumer a producer, so that buying in the cheapest market does not necessarily benefit the mass of individuals or a nation. Indeed, this comparison of home and foreign prices must be attributed to the belief that money pays for imports, or that the advantage of international trade lies in saving money, whereas every economist insists that imports are paid for by exports or services, or that the advantage of international trade lies in economising labour.

The sole alternative to Free Trade that has been proposed is a system of tariffs. But the avowed object of Customs duties is to raise revenue, and in so far as a duty on competitive imports yields a revenue the national output is diminished. Moreover, in these days a tariff of 100 per cent. would hardly suffice to safeguard the home market for some industries—the new Tariff Act in the U.S.A. has raised the average to 60 per cent. *ad valorem*—while no tariff which has ever been conceived would prevent the dumping of agricultural produce.

The true alternative to Free Trade is regulated trade, and the regulation of international trade involves no Customs duties whatsoever. All that is necessary is a ban on competitive imports, with the issue of licences for their importation if the home production is insufficient to meet the home consumption. This principle was actually adopted in the Dyestuffs Act, under which the British chemical industry has made gigantic strides since the year 1920. To ensure a continuous growth in the national output, the same principle must be applied to all industries, including agriculture. Here is the solution of the eternal fiscal controversy. From a scientific investigation into the problem of international trade, no other deduction is possible.

* Author of "Unsolved Problems: National and International," "The Real Wealth of Nations," &c.

Books of Reference.

Ice and Cold Storage Trades Directory and Reference Book for 1931. London: Published from the offices of *Ice and Cold Storage*, Dorset House, Tudor-street, E.C. 4, price 11s. post free.—Upwards of 60 pages of this year's issue are devoted to tables containing a large amount of useful information in handy form. Then there comes a list of companies registered since December, 1929, the articles of association, of which include refrigeration. Following this there are particulars of the British Association of Refrigeration, of the Meat Trade Association, of the National Federation of Cold Storage and Ice Trades, and of the Institut International du Froid. Then there comes a list of places with cold stores and ice factories, which runs to over 25 pages, and, finally, there is a classified trades list.

Manual of Electrical Undertakings and Directory of Officials. Vol. XXXIII., revised to September, 1930. London: The Electrical Press, Ltd., 13–16, Fisher-street, Southampton-row, W.C. 1. Price 35s. net.—This year's "Garcke" contains financial, technical, and general information concerning 5500 undertakings covering all branches of the electrical industry. In addition, there is a directory, with names and addresses, of some 20,000 directors, executive officials and contractors. A new feature has been incorporated in the data of each supply undertaking, namely, a list of the areas supplied. Having said that much, there is really nothing that remains to be told. Everyone who has any connection, however remote, with the electrical industry knows how useful his "Garcke" can be, so that really all that is needed from us is to call attention to the fact that this year's issue has made its appearance.

Harrison's Business and General Year Book of South Africa and Adjacent Territories, 1930–1931. Printed and published in South Africa by the *Natal Witness*, Ltd., Pietermaritzburg, Natal. Price, one guinea.—This book contains a large amount of information regarding the countries with which it deals, incorporating as it does particulars concerning trade, industries, products, resources, administration, railways, harbours, shipping, customs, travel, &c., and we are informed in the Preface that the present issue—the sixth—has been revised to the latest possible date. It is divided into five parts:—(1) The Union of South Africa; (2) South-West Africa; (3) Lorenço Marques; (4) Southern Rhodesia; and (5) Beira and Hinterland. Naturally, the first part is the longest, running as it does to over 500 pages. It is subdivided into twelve sections, each treating of separate subjects. Persons having business relations with South Africa should find this book of reference particularly useful.

The "Mechanical World" Electrical Pocket Book, 1931. Published by Emmott and Co., Ltd., 65, King-street, Manchester, and 20, Bedford-street, Strand, W.C. 2. Price 1s. 6d.—It is hoped that, with the increasing and expanding of the undertakings served by the "Grid" system of electrical energy, the considerable and rapidly multiplying body of engineers and electricity users will find in this year's issue of the Pocket Book much information and data of a directly useful character. With that object, new contributions dealing with the operation and maintenance of heavy power plant and traction have been embodied in it. Furthermore, the sections on lighting circuits and switching have been entirely revised, while those concerning lamps and lighting have been expanded and brought up to date, as also have those dealing with D.C. generators and motors, synchronous, induction, auto-synchronous, synchronous-induction and traction motors. Indeed, this little book promises to be even more useful than those which have preceded it.

IT is stated in the annual report of the Federated Malay States Mines Department that the use of oil engines is still on the increase among the local Chinese, especially those of large horse-power, the supply of which comes very largely from the U.S.A., though Germany has also entered the market with some success. Such British engines as are used, the report goes on to say, are small, and are used generally for agricultural purposes. The reason for the lack of success shown by the large units of British manufacture may be found in the easy terms of purchase offered by the competing countries, and, moreover, by the service given during and after purchase.

The Scattering of Light.

A DISCOURSE on the "Scattering of Light" was delivered by Sir William Bragg at the Royal Institution on the evening of Friday, January 23rd. This Discourse was the first to be held in the reconstructed theatre of the Institution, the work of converting which into a structure of steel and concrete, and the extensive additions and renewals of other parts of the building, occupied eighteen months and cost about £90,000. The whole of that sum was obtained in various ways, a considerable portion of it in the form of gifts from the Pilgrim Trust and from generous donors.

The subject of the discourse had, Sir William explained, a historical connection with the Royal Institution. In its earliest form it asked for explanations of the blue of the sky and sea. Professor Tyndall and the late Lord Rayleigh had been among the earliest and most important contributors to the solution of the problem. Tyndall was especially interested on account of his researches into the origin of the ultimate putrefaction of broths and the like, when exposed to the air, because he maintained that the life generated in such media was due to minute organisms which the air held in suspension. Such minute bodies were revealed by the light which was scattered by them in the same way as dust and other particles lit up a ray of sunlight entering a dark room. He believed that if air were completely freed from floating particles, there would be no scattering. The sky, as seen from the top of a mountain high enough to be above the dust layer of the earth, would be black, unless particles of water vapour were present to cause scattering. Rayleigh put the theory on a sound basis, and explained exactly why the blue was scattered more than the red, so that it was turned aside while the red passed on. The same explanation was applicable to the colours of the rising and setting sun. Rayleigh showed, also, that there was no need to postulate the presence of water vapour; the molecules of the air itself were sufficient to explain the amount of the scattering. That was subsequently demonstrated by observations of the light of the sky at the observatory on Mount Wilson in America, and by the laboratory experiments of the present Lord Rayleigh.

In recent years the interest of the subject had been greatly increased by the discoveries of Professor Raman in Calcutta. He had shown that there was a form of scattering which, hitherto, no one had observed. Some of the original light was scattered with change of colour, and that change was capable of the most precise measurement. A host of observers in various parts of the world had busied themselves with the extension of Raman's discovery; a new and most fascinating field of research had been opened up. The change mentioned depended on the nature of the scattering atoms and molecules, the properties of which were thereby made capable of closer observation. Moreover, the explanations of the new effects were more easily expressed in terms of the quantum or corpuscular theory of light, and in that way the highly attractive mystery of the nature of light was still further enhanced.

Exhaust Steam Turbine Installation for the "Kingswood."

THERE exists in some quarters a mistaken idea that the use of an exhaust steam turbine geared to the propeller shaft, to increase the power and economy of reciprocating engined steamships, is a novel device of continental engineers. Reference to the patent taken out by Sir Charles Parsons in 1906 will, however, show that the credit must be given to this country, the patent in question not only covering the principle, but dealing with the details necessary to render harmless the inequalities of tooth-pressure due to the different characteristics of the two types of engine. That the system lay dormant for many years was in no way due to any defect in it. The success attained with gearing on the "Vespasian" in 1910 showed that even for slow cargo boats an all-turbine installation was not only perfectly practicable, but also more efficient than the usual marine engine, and the subsequent tendency to raise steam pressures and temperatures still further limited the outlook for the reciprocating engine. Hence it is not surprising that the all-turbine system rapidly became the standard. To fit an ordinary reciprocating engine in a new vessel nowadays, even though provided with an exhaust turbine to expand the steam down to condenser pressure, can hardly be considered as other than a step backward, although credit must be given to those engineers who, by means of improved valve gears and cylinder arrangements, have made the reciprocating steam engine more economical and more suited for the use of high-temperature and high-pressure steam. Nevertheless, where reciprocating engines already exist, the addition of a turbine geared to the propeller shaft, as proposed so long ago by Sir Charles Parsons, can undoubtedly prove a source of great economy.

A recent installation of this kind, designed and constructed by the Parsons Marine Steam Turbine Company, Ltd., at its Turbinia Works, Wallsend-on-Tyne, for the s.s. "Kingswood," owned by the Joseph Constantine Steamship Company, of Middlesbrough, is illustrated in the engravings and drawings herewith. The turbine receives steam from the exhaust of the low-pressure cylinder of the reciprocating engine, and drives the main shaft through double reduction gearing. The turbine is designed to use steam at 8 lb. absolute pressure and to develop 575 shaft horse-power. Taking this power as equivalent to 650 I.H.P., and allowing for the reduction in engine power due to the increased back-pressure, the power of the vessel is increased by the addition of the turbine from 1750 I.H.P. to 2100 I.H.P., with no increase in the fuel consumption.

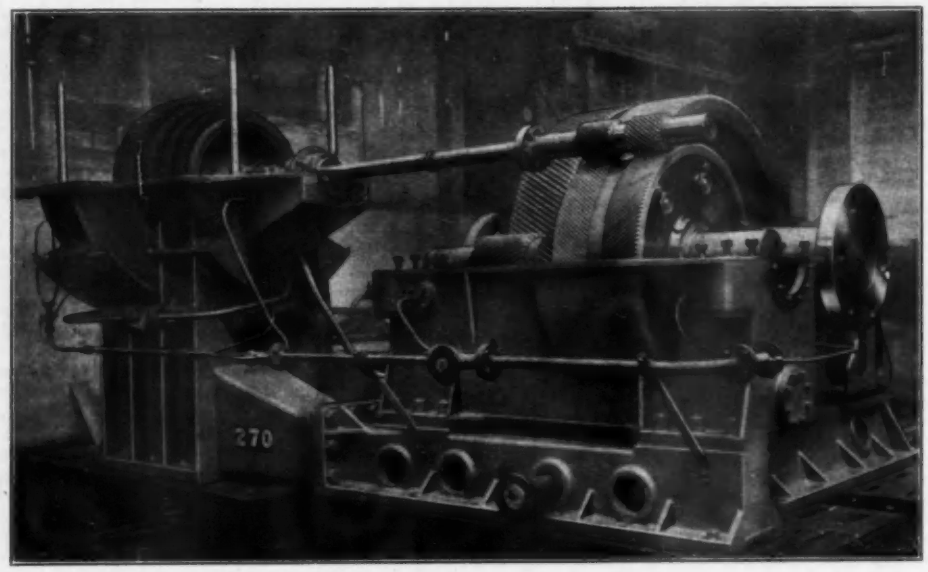
As will be seen from the drawings on page 157, the exhaust steam leaving the engine passes to an exhaust control valve, which directs it normally through a separator to the turbine inlet. The control valve is steam-operated. When the main engine is reversed a small change-over valve mechanically connected to the weigh shaft causes the control valve to direct the steam straight to the condenser. The turbine is then driven idly backwards by the gearing and runs in a vacuum. A failure of oil pressure in the turbine system also has the effect of operating the control valve and turning the steam to the condenser.

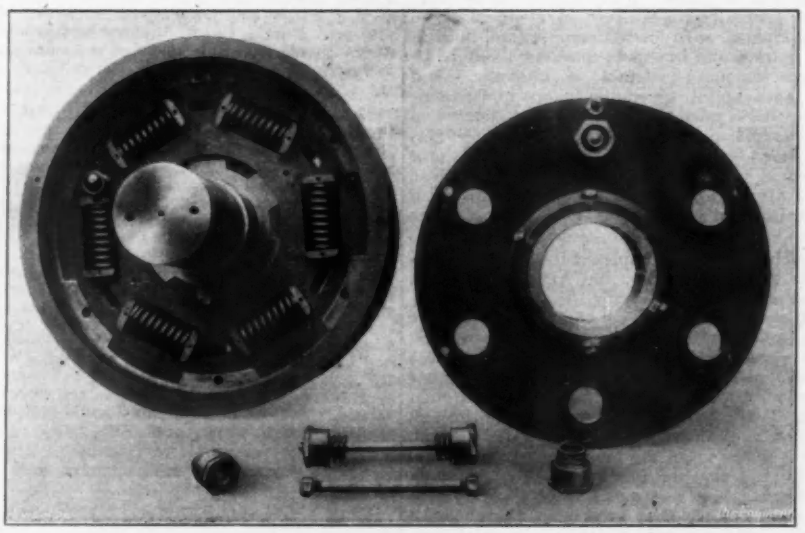
The turbine is of the simplest possible description, comprising merely ten running rows of blades on the surface of a drum forged solid with the shaft. The low pressure of the steam with which it works enables abundant clearance to be given over the blading, which is, moreover, of Messrs. Parsons' thin-tipped type, and is capable of standing accidental contact without noticeable harm resulting. The turbine is coupled to the primary pinion of the double-reduction gearing, through a shaft of small diameter which is provided with a double-claw coupling to permit of independency of alignment of turbine and gear. The gear case itself is also supported at one side by springs, so that the alignment of the gear shall not be affected by any possible wear of the crank shaft bearings of the main engine.

In such a combination of machinery there is, however, much more than alignment to consider if the gear is to run smoothly. Some provision has to be made to relieve the teeth from shocks due to the irregular turning moment of the engine, or to sudden changes in load, such as might occur should the propeller come out of the water in a rough sea. This is effected by an elastic coupling which is incorporated in the primary wheel of the gearing. This coupling, parts of which are illustrated, embodies both elastic and frictional transmission, and effectively absorbs any shock. It consists of a series of plates alternately

GEARED EXHAUST TURBINE SET FOR S.S. "KINGSWOOD"

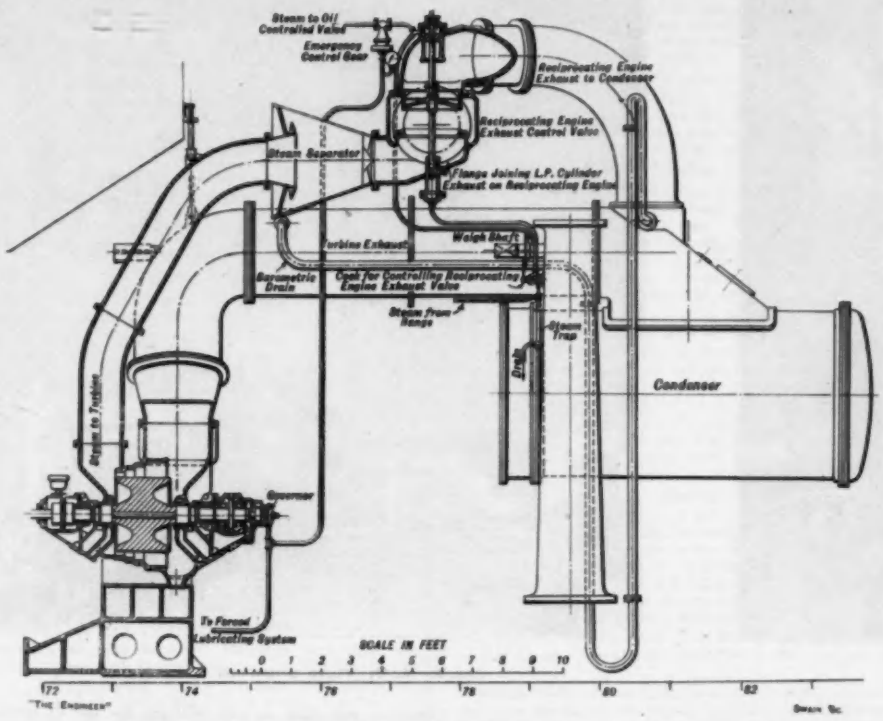
PARSONS MARINE STEAM TURBINE COMPANY, LTD., WALLSEND-ON-TYNE, ENGINEERS





DETAILS OF ELASTIC COUPLING

connected to the shaft and the wheel, which are pressed together by a set of light springs, the pressure being so adjusted that the friction of the plates is sufficient to resist about half the driving torque. The remainder of the torque is taken by stiff springs, set tangentially, as shown in the photograph, which limit the frictional slip of the plates, to the amount the springs can be compressed. The stress on the springs under normal compression does not exceed about 4 tons per square inch. Couplings



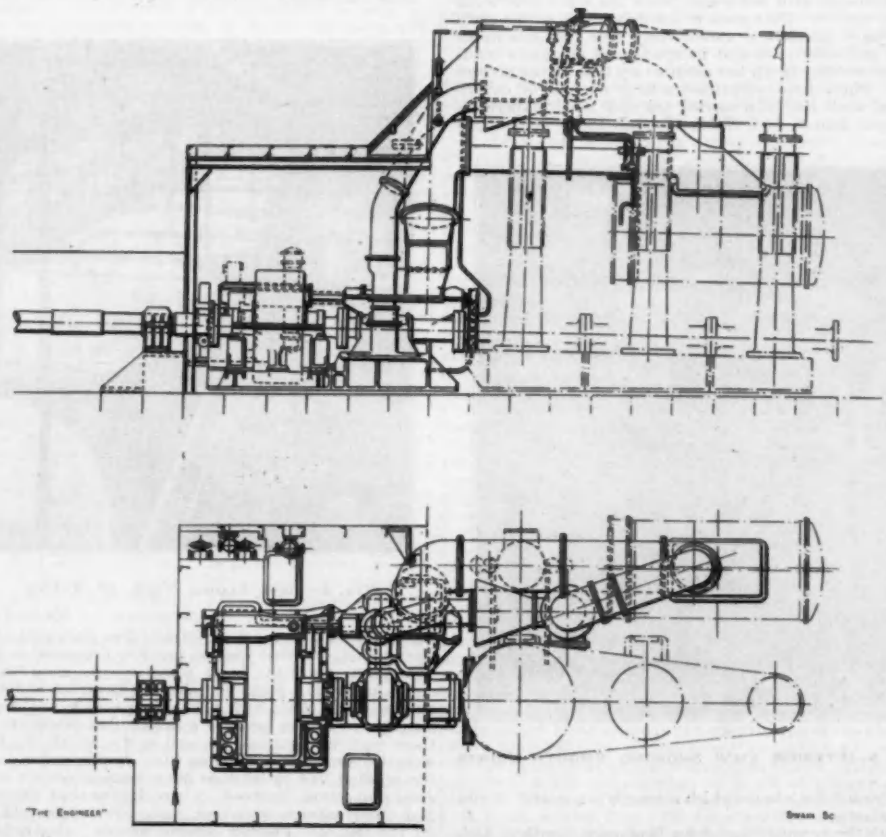
SECTION THROUGH TURBINE SHOWING CHANGE-OVER VALVE CONNECTIONS

of the type in question have now been running at sea for a number of years and have been found to answer their purpose perfectly and to give no trouble.

One of the engravings shows the turbine and gear box completely assembled as they appeared in the Turbinia Works when ready for the bench trials.

On Thursday and Friday afternoons of last week—January 29th and 30th—the Parsons Marine Steam Turbine Company, Ltd., invited its licencees, along with representatives of marine engineering and shipping interests, to inspect the installation at Turbinia Works. The turbine was steamed and was run up to full power revolutions, without, however, any load being put on. When the steam was cut off and the turbine was allowed to come to rest, a particularly good opportunity was afforded of noting the very quiet and steady running of the gearing. The turbine itself is designed to work at a speed of 2500 r.p.m., and the speed of the first reduction pinion is 380 r.p.m., corresponding to a propeller shaft speed of 65 r.p.m. The reciprocating steam engine from which the supply of exhaust steam will be taken was built by the North-Eastern Marine Engineering Company, Ltd., of Wallsend, and has three cylinders with diameters of 24½in., 40½in. and 68in. respectively, and a stroke of 45in. The working steam pressure is 200 lb. per square inch.

The turbine and gearing we have described are now being prepared for putting aboard the "Kingswood," and it is hoped that the official trials of the new installation will be run some time in the early part of next month. The performance of the ship will be awaited with interest, as the installation will be the first of its kind embodying the Parsons patented system for a combined reciprocating and geared turbine plant. The elastic coupling, shown on page 156, however, has been tested at sea for some years under severe conditions, with, we understand, every satisfaction. Couplings of this particular type were installed in Alfred Holt's Blue Funnel 10,000-ton steamer "Menelaus," about six years ago, and they are, we are informed, still giving excellent results. All those who inspected the turbine and gearing at Turbinia Works were impressed by its quiet running, the soundness of the mechanical design, and the very convenient layout of the plant.



GENERAL LAY-OUT OF ENGINE AND TURBINE

Some New Ideas on Dams.*

By EDWARD GODFREY, M. Am. Soc. C.E., M.I. Struct. E.

DAMS are among the oldest of engineering works, the efforts of men to control and alter Nature; and while only a few engineers are engaged in the work of building dams, the whole of the profession suffers in the disgrace that follows in the wake of the disastrous failure of a dam. Practically every failure of a dam can be explained in one phrase, namely, under-pressure and neglect to provide for under-pressure in the design of the dam. This applies not only to masonry and concrete dams, but also to earth dams.

Very few modern writers lay any emphasis on under-pressure. Most of them treat it as something of only academic interest. Some writers seriously think it can be eliminated by the simple process of grouting up fissures in the foundation. Others believe that a few drain pipes—weep holes—with outlets that may freeze up, will solve the problem. It is easy to ignore under-pressure in making a report on the failure of a dam, to blame the failure on geology, and soil, and God. It is not so easy to meet it face to face and reason it away when, as is almost universally the case, the mere assumption that it has acted is all the explanation needed to clarify the whole matter of the failure, and when it is not in the nature of materials to stay in place in the face of that assumed pressure, given the design as it is.

The principle of under-pressure is so simple that the mere mention of it as a force acting against the stability of a dam ought to be sufficient, to anyone familiar with the laws of hydraulics, to make its inclusion in all designs of dams a foregone conclusion. It is known that water will penetrate the finest crevice, that, if it does not have outlet, it will accumulate a head or pressure measured by the vertical distance to the free surface. There has been much written in the way of speculation as to what proportion of a grain of sand or of a stone may be in contact with the adjacent grain of sand or stone, and thus reduce the pressure by that proportion. Some writers satisfy themselves by reasoning in this way, that only a fraction of the pressure of the water could be effective in tending to lift a dam. If they would carry their reasoning just a little further and ask themselves "What about the pressure against the next layer of sand?" they would see that what one grain may lack in contact, the next grain gains by its force against the first. No one can seriously claim that a cylinder filled with sand, and water in the interstices of the same, the latter being subject to hydraulic pressure, will have anything but the full hydraulic pressure. The only possible condition in which any reduction of pressure could exist, assuming either the thinnest fissure, saturated sand or saturated earth beneath a dam, is reduction due to escape of the water.

Water leaks beneath a dam are common, and here is a sinister fact. The most natural thing for a caretaker to do when leaks are discovered is to plug them up. This is like driving a gigantic wedge beneath a dam to overturn it. Many dams have actually failed by reason of the acts of caretakers in plugging up downstream leaks. The immediate effect is to cause the water under the dam to accumulate its full head. In one failure, a hollow dam, totally inadequate in weight to remain in place against under-pressure, failed by reason of the apparently inconsequential fact that the city authorities drove wooden plugs into the weep holes to prevent the loss of water. In one or more other failures of similar dams, Nature plugged up the weep holes with ice, and the dams floated out.

It seems to be the idea in some engineers' minds that if a failure is due to the uplifting force exerted by under-pressure, the dam must turn over, revolving about the downstream edge. A little reasoning will show that no such action need follow. Suppose under-pressure raises a dam by a very slight amount. It will then be resting on water and be thoroughly lubricated. The horizontal pressure of the water on the upstream face will then act immediately to slide out the section of the dam on its lubricated support. It is only necessary to think of the mobility of this body of water to see that it would slide out the blocks long before sufficient water could enter the crevices beneath the blocks to turn them over. Another action that would follow rapidly, where a dam is resting on anything but rock, is the quick eroding of the soil beneath the dam immediately a fissure is opened up by under-pressure. It is this action that has given rise to the false notion that is met with in nearly all expert reports on dams, namely, that the failure is one of foundation, or of the soil beneath a dam.

The latest, and one of the greatest of large dam failures, is the St. Francis dam in California. The cross section of that dam in every part that failed was exactly 65 per cent. as wide at the base as the height. For all of this portion absolutely no attention was paid to under-pressure, for these are exactly the proportions of a solid concrete dam that is designed for the pressure of the water on the upstream side, and that alone. Any under-pressure whatever exerted on a dam of these proportions begins to open up the base at the upstream edge for the admission of water and more pressure. This is the sole reason for the failure of this structure. The middle portion of the St. Francis dam had a greater relative width of base than the rest of the dam. The ratio approached 85 per cent., which is the ratio for complete stability against all the horizontal and vertical pressure that can be computed or assumed. Besides this wider base, there was an attempt at under-drainage in this middle portion. That middle portion stood and many months later was blasted away. During those months it was stark evidence that the whole dam would have been absolutely permanent against all the water Nature could have piled against it, if the designer had recognised under-pressure and made the base of the rest of the dam 85 per cent. as wide as its height.

The Gleno dam, in Italy, which failed a few years ago is a somewhat different case. The cause of the failure is exactly the same as that of the St. Francis dam, namely, under-pressure. The upper portion of this dam was of cellular construction; that is, it was composed of buttresses and arches. The weight of this portion was totally

* Read before the Institution of Structural Engineers, January 22nd, 1931.—Abstract.

ELECTRICALLY-WELDED TANKS FOR A DISTILLERY

JOHN THOMPSON (DUDLEY), LTD., ENGINEERS

FIG. 1—WELDED TANKS IN POSITION

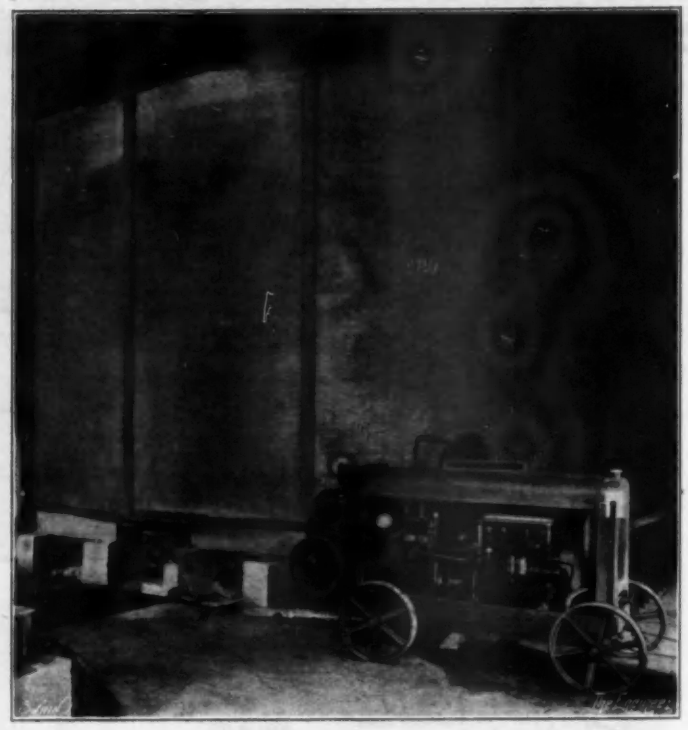


FIG. 2—NEAR VIEW SHOWING JOINTS

inadequate to remain in place against the upward pressure of water in a horizontal joint, and the arch pressures would not help to hold it down, for they did not strike this base joint. The base portion was masonry laid in lime mortar. The most natural thing, if these lime mortar joints should leak, was to plaster them up with cement mortar on the downstream face. This would raise the pressure in the lime mortar joints to full head, for water could readily enter a lime mortar joint. The next most natural thing was for the entire upper part of the dam to be lifted off at a joint just below the cellular part by the hundreds of millions of pounds of pressure exerted in a vertical direction and totally unprovided for in the design. This is exactly what happened. The upper part was lifted off. But this was not brought out in any of the engineering reports on this failure. Soil and geological formation were blamed.

So-called blow-outs in dams can readily be explained by the presence of compacted soil or paving over spots or areas where the subsoil is of a semi-fluid nature. All that is necessary is for the head of the body of water to be communicated to this substratum by reason of failure of the water to escape. When this head exceeds the weight of the overlying compacted earth or paving, the latter rises on account of the under-pressure.

The design of dams will never be on a sound basis until engineers recognise under-pressure as of just as much importance in proportioning a dam as the pressure of water on the upstream face of the dam.

THE JUBILEE OF "LE GÉNIE CIVIL."

WE have been favoured with a copy of the special number that has been issued by our contemporary *Le Génie Civil*, to mark the occasion of its Jubilee, which took place in November of last year. It is an exceedingly well got-up volume of the same size as the ordinary issue of the paper, and runs to over 230 pages. Advantage has been taken of the event to get together and publish in one volume a numerous series of articles—many of them excellently illustrated and all of them written by men of note in the particular branch of activity with which they deal—setting out the progress made in various directions during the fifty years that that celebrated engineering newspaper has been in existence.

Among the many subjects discussed may be mentioend :—Aeronautics, Agriculture, Architecture, Artillery, Automobiles, Bridges—masonry, concrete and steel—Chemistry, Commerce, Dams, Electricity and Electro-metallurgy, Engines of various types, Geology, Glass, Hydro-electrics, Legislation as applied to industries and labour, Lighting, Metallurgy, Mining, Naval Matters. Non-ferrous Metals, the Strength of Metals, Ports, Public Works, Railways and their electrification, Roads, Science, Surveying, Telephony, Textiles, Tunnels and Wireless Communication. One and all of these articles are most informative, and the whole constitutes a comprehensive survey of the advances which have taken place during the last fifty years.

We can imagine no better way of celebrating the Jubilee of a journal devoted to engineering matters than the publication of the present book, and we congratulate our contemporary not only on having reached its Jubilee with such distinction, but also on the happy way which it has chosen to commemorate the fact.

WE hear that the employees of Ferranti, Ltd., Hollinwood, have decided to endow a bed in the Oldham Royal Infirmary in memory of the late Dr. S. Z. de Ferranti.

Electrically-Welded Tanks at a Distillery.

LIKE other new processes, electric welding was not accepted in the engineering world without passing through a probationary period in an atmosphere of doubt and suspicion. While manufacturers have always appreciated the advantages of the system for certain classes of work, it was felt in many quarters when the construction of vessels subjected to pressure and other similar work requiring an ample margin of safety came under consideration that in dispensing with bolts and rivets too much was being left to chance. That some of the misgivings in the early days were justified is undoubtedly true, for unsuitable plant and electrodes and inexperienced operators made electric welding much less satisfactory than at the present time. Since those early times a large amount of experimental work has been carried out and much experience has been gained, with the result that the system is now

FIG. 3—INTERIOR VIEW SHOWING SMOOTH JOINTS

widely used for jobs on which strength is a matter of vital importance.

With the permission of John Thompson (Dudley), Ltd., we show in Figs. 1 and 2 a group of tanks erected by it at a large distillery in the North of England, and on which the circumferential plating is a departure from standard practice. The plates are continuous throughout from the bottom to the top, a vee butt weld being employed on the inside—see Fig. 3—and a welded butt strap on the outside, as shown in Fig. 2. A view of the tops of the tanks is given in Fig. 4. The construction, the makers point out, not only ensures a joint having a strength greater than the plate itself, but it also improves the appearance of the structure. The plates were, of course, cut, rolled and prepared in John Thompson's works, but the whole of the erection was done on site without the use of bolts and rivets. The tanks are used for the purpose of conserving large quantities of hot fermenting liquor which gives off a heavy gas at certain temperatures and which behaves in a peculiar way. If kept in circulation its action on a plain surface of steel is negligible, but if permitted to remain in the same place for any length of time it has a corrosive effect. Experience has shown that if the liquor is stored in an ordinary riveted vessel rapid deterioration of the vessel takes place, owing to the tendency of the gas to lodge under projections, such as bonding edges and rivet heads, gussets, &c., where it gives rise to deterioration of the metal.

These undesirable conditions clearly indicate the advan-

FIG. 4—VIEW ALONG TOPS OF TANKS

tages of a tank with a flush interior free from projections of any kind, and that was the problem presented to John Thompson (Dudley), Ltd., when it was awarded the order for twelve tanks for the distillery, each 30ft. in diameter and 25ft. high. The firm's technical department proceeded to produce a design that complied with these unusual requirements, and in due course the tanks were delivered and erected on site. As the major part of the welding had to be done on a vertical surface and a good proportion overhead, it may appear that difficulties and disadvantages were met with, but we are told that by the use of "Premier general service" electrodes no trouble was experienced, and all the tanks passed their test entirely satisfactorily. The sequence of welding when operating on work of this kind is a matter of great importance, and care must be taken not to permit the contractional stresses subsequent upon welding to accumulate, otherwise the ultimate stress at various parts of the structure may reach the danger limit, to say nothing of the distortion that must ensue. Electric welding, the makers of these tanks point out, provides the strongest and most rigid form of construction, but it is futile to regard it as a foolproof operation, requiring no knowledge or experience.

Railway and Road Matters.

AN answer given by Mr. Morrison to a question addressed to him on January 28th showed that the London, Midland and Scottish Company has in contemplation some electrification of its lines in the Glasgow area.

FIGURES issued by the Southern Railway Company show that the coal carried by rail from the Kent coalfields was over 1,000,000 tons in 1930. Of this quantity, one-quarter is used by the railway company and the bulk of the remainder in cement and paper works in Kent.

IN the King's Bench Division, on January 28th, a rule *nisi* was granted, on the application of a motor coach company, calling on the Minister of Transport to show cause why a writ of prohibition should not be issued in connection with his proposed Order as to the use of motor coaches in the main area of the Metropolis.

UNDER Sec. 19 of the Road Traffic Act, the hours of duty of the drivers of certain motor vehicles is to be limited. The section was to come into operation on February 1st, but the Minister has postponed the date until April 1st to allow for the completion of negotiations between the parties for a joint application for the provisions of the section to be varied.

THE National Wages Board resumed on Monday, February 2nd, the hearings as to the railwaymen's pay and conditions of service. The part now being heard is the unions' demands for improvements in conditions. Mr. C. T. Cramp, speaking at Croydon on January 21st, said that "later still the real struggle would commence, but not in public sittings, when the parties on their respective sides would strive to arrive at the best solution of the difficulty."

EXPERIMENTS in the use of pneumatic tires on railways were carried out on the Issoudun-Saint Florent line a few days ago by the Michelin Company. The directors of the Nord, Est and Orléans railway systems were present. Petrol rail motor cars fitted with pneumatic tires have already been in use for several months on secondary lines. The advantages that would result from the general use of such tires on railway rolling stock were revealed by the trials. It is pointed out that the new system does away with noise and the wearing of the rails, and would be a great boon if applied to passenger coaches.

ACCORDING to the Railway Returns for 1929, the average train load for the four grouped companies was :—Southern, 107·66 tons; Great Western, 138·47 tons; London, Midland and Scottish, 126·64 tons; London and North-Eastern, 138·07 tons. The net ton-miles per engine hour was :—G.W., 339·01; Southern, 440·49; L.M. and S., 443·38; L. and N.E., 469·79. The net ton-miles per route mile per annum was :—365,518, 914,499, 1,089,748, and 1,020,108 respectively. The average length of haul was :—G.W., 40·86 miles; Southern, 40·43 miles; L.M. and S., 47·80 miles; and L. and N.E., 41·04 miles.

IN its issue of January 31st *The Times* reported from its Berlin correspondent that the board of the German State Railway Company has decided, in support of the Government's measures for alleviating unemployment, to accept a long-term credit of about £2,500,000 offered by the great firms of the electrical engineering industry. The credit, the precise period of which is not stated, will be used for railway electrification schemes in South Germany, and it is understood that the Reich will guarantee the interest on it until this is covered by the economies arising from the electrification. The undertaking should find work for about 10,000 men for eighteen months.

As had been expected, practically only Swedish materials will be used for the electrification of the Stockholm-Malmoe line and the junction lines. The Railway Board has already concluded preliminary agreements with several Swedish enterprises, including ASEA, Svenska Metallverken, Finspongs Metallverk and Elektromekano of Haelsingborg, for the supply of electric locomotives, transformer stations and transmission line. Even the raw materials for the latter will be Swedish, the State Railways having agreed with the companies concerned and the Boliden ore-mining company that the copper shall be supplied from the company's mines and smelting works in the Skellefteaa district.

THE report by Lieut.-Colonel Anderson on a collision at Cleethorpes, London and North-Eastern Railway, was issued on February 2nd. The accident occurred on October 3rd, and was between an arriving up passenger train and a light engine, which met tender to tender. The mishap occurred through the signalman inadvertently moving a facing crossover-road between the time the light engine passed its signal and its arrival at the points, with the result that the engine was sent on to the up line in the face of the arriving passenger train. The driver of the light engine saw the error and stopped. His alertness is said to have materially contributed towards a reduction of the effect of the collision. The points are immediately in front of the signal-box, and Colonel Anderson says that the addition of track circuit or other such equipment was hardly justified in the circumstances.

THE railway signal engineering profession lost one of its leading members on January 28th when Mr. Ernest Copeland Irving died after a long period of indifferent health. Mr. Irving was born in Suffolk, but learnt the art of signalling on the Pennsylvania and other American railways. He returned to this country some thirty years ago, when the British Pneumatic Railway Signal Company—now the British Power Railway Signal Company—was formed. The system exploited was the operation of points and signals by low-pressure compressed air in contrast to the comparatively high-pressure method of the Westinghouse Company. In contrast also to the latter company's system, the controls were pneumatic and not electric. The first plant was installed at Grateley, on the London and South-Western, and was opened on July 31st, 1901. The 6 miles from that station to Andover were equipped with track circuit, and automatic signals, which was opened on April 20th, 1902, and formed the first installation of any size of that character in this country. The same company also provided at Wath, on the Great Central, the first push-button machine for operating the points in hump shunting yards, and at Keadby, also on the Great Central, the first complete installation of upper quadrant signals.

Notes and Memoranda.

ACCORDING to Mr. S. J. Hazlett, the use of a Diesel engine, in place of a petrol set, will effect a saving of from £200 to £300 in the case of a heavy lorry doing about 100 miles a day.

TAKING the Ontario goldfields together, the tonnage milled during the eleven months ended November 30th, 1930, amounted to 3,544,722 tons, with a crude bullion recovery of 32,318,621 dollars, as compared with 3,665,579 tons and a crude bullion recovery of 30,341,894 dollars during the same period in 1929.

THE total production of mineral oil in Canada is now at the rate of over 1,400,000 barrels a year, which represents an increase of 40 per cent. over the returns for the previous year. The gas produced last year from the Alberta fields and used for industrial and domestic consumption amounted to nearly 20,000 million cubic feet.

THE new sulphuric acid plant of Canadian Industries, Ltd., at Copper Cliff, near Sudbury, Ontario, has an output of 150 tons of acid a day. Half of this amount is used in making nitre cake, as a flux for separating copper and nickel. The other half is marketed. The sulphur for the acid is obtained from the smelter flue gases, while the sodium sulphate for the coke comes from Horse Shoe Lake, Saskatchewan.

SOME experiments were carried out by the American Bureau on the strength of pedestals or stools for building columns built up of plates welded together. One of the stools had the side plates machined to fit the base-plate and a fillet weld was used for attaching one to the other. In the case of the other stool the side plates were assembled clear of the base and the gap was filled in with welding. It was found that the stresses under load of the plates were twice as great in the first case as in the second.

A BELT conveyor at a Pittsburg colliery is so heavily loaded that it must be driven by two pulleys. The belt, naturally, stretches slightly between the two drivers, and this stretch varies with the load. As a consequence, the two drivers have to run at different peripheral speeds. Various means were tried for interconnecting them, with no success until each was driven separately by a wound rotor electric motor with a characteristic of decreasing speed with increasing load. The motors are of 250 H.P. and 75 H.P., and the arrangement was found cheaper than any alternative.

IT seems rather remarkable that a reputable insurance corporation should undertake the insurance of a boiler without insisting on a proper inspection, but such was the case with the vertical boiler of a steam drifter working out of Scarborough. The stays connecting the fire-box with the shell protruded into the fire space and were there fitted with nuts. Several of the nuts were burned off by the fire and such violent leakage occurred that the vessel was crippled. Fortunately, no one was seriously hurt. The carelessness of the underwriters is commented on by Mr. A. E. Laslett, of the Board of Trade.

IN a condensed milk works in Wiltshire the exhaust from an engine was used for process work, or it could be discharged to atmosphere or sent to a condenser. The arrangement naturally involved the introduction of several valves. After some repairs had been executed the engine was started up with all the valves in the exhaust system inadvertently closed. A steam receiver connected with the piping blew up on account of the accumulation of pressure and two men were badly scalded. It is obvious that with such an arrangement a large-sized relief valve should have been fitted on the exhaust.

A STEAM pipe supplying a pump in a North Country spinning mill unexpectedly exploded and very nearly seriously injured a man. The pipe was of the lap-welded wrought iron type, 3¾in. in bore by ¼in. thick, and was about forty-five years old. The welding was obviously defective and the steam opened in ordinary working, allowing a great volume of steam to escape. The pipe had been inspected by an engineer of the insurance company, but the lagging was not removed, a procedure which the Engineer Surveyor-in-Chief deprecates. He recommends the stripping of the lagging and a hydraulic test.

IN the course of a paper before the Institution of Automobile Engineers, on "Rustless Steel as Applied to Automobiles and Aircraft," Dr. W. H. Hatfield said :—"With regard to motor car wheels, it is interesting to record that a number of wire wheels made in this steel are now undergoing road tests. The rims of such wheels are formed from strip material, and are electrically butt or flash welded. For the spokes of such wheels wire is required with a tensile strength of about 65 tons per square inch. This condition is induced by cold drawing. Such wire has subsequently to be swaged, headed and screwed. The production of nipples for these spokes has proved a somewhat difficult problem, but these have now been successfully produced by semi-automatic means."

FROM time to time news is received of a proposal to discharge a rocket into the remote spaces above the earth for the purpose, generally, of scientific research, but in no case have we ever heard of any of these proposals being successfully carried out. In at least one case it was proposed to shoot the rocket to the moon. In most, however—as in the recent proposal made by the Smithsonian Institute in America—less ambitious heights were aimed at, the object being to study the composition of the atmosphere 50 or 100 miles above the earth's surface. In each case the rocket is a compound arrangement, the successive sections of which are designed to go off at prearranged heights. The most recent proposal is ascribed to Dr. E. O. Lyon, of New York. Dr. Lyon's rocket is to be built of steel and beryllium, and will weigh 3 cwt. The explosive to be used, it is stated, will be of a new type. We gather that it will rely for combustion at great altitudes, where free oxygen is scarce, on oxygen derived from chlorates or similar substances. A gyroscope is to be employed to hold the rocket on its set course and an automatic parachute to lessen the force of the return of the rocket head to the earth. The head will contain automatic instruments for sampling and otherwise measuring the properties of the atmosphere at heights up to 50 miles above the earth's surface. The experiments, it is stated, are to be carried out from the top of an Alpine mountain near Lake Como.

Miscellanea.

DURING the past year thirty-seven new oil wells were brought in in the Turner Valley field of Alberta. They yield as much as 700 barrels of naphtha daily.

IT is proposed to drill the St. Lawrence River valley, in the district between St. Hyacinthe and Three Rivers, for natural gas. A well drilled there in 1885 to a depth of 1115ft. has produced gas ever since.

A MESSAGE from Baku says that the first cracking plant in the Soviet Union, to treat 125 tons of crude oil a day, has been put into operation. All the machinery, with the exception of the pumps and the checking apparatus, was manufactured in Russia. The plant was completed in nine months and the cost of construction amounted to 560,000 roubles.

THE Municipality of Satara, in the Bombay Presidency, has decided upon a scheme for improving the water supply to the town and the adjoining cantonment at a cost of 2·34 lakhs of rupees, to ensure a daily supply of 600,000 gallons of water all the year round. The present supply is obtained from the Kas, Yeoteshwar and Maharda tanks, all overlooking a plateau about 3½ miles distant.

IN a recent issue of the *Madras Mail* prominence was given to details of the Lower Bhavani irrigation project, which has been under investigation by the Madras Government Engineers. The dam will be near Satyamangalam, at a place called Kothamangalam. The circumference of the reservoir will be about 50 miles and the catchment area about 200 square miles. The dam itself will be as long as that under construction at Mettur—that is, about a mile—and the main canal will be about 80 miles long. The project when completed will irrigate some thousands of acres in the Satyamangalam, Gobi and Erode Taluks, and is estimated to cost 207 lakhs of rupees.

IN the reports of the discussion of the Second Plenary World Power Conference it has only been possible to deal very shortly with many of the details, but the office of the Second World Power Conference can at any time give the full wording of the contributions to the discussion, which, in almost all cases, were communicated in writing. Those desirous of receiving the full text should apply to the office of the Second World Power Conference, Ingenieurhaus, Berlin, N.W. 7, when the information will be supplied at the rate of 0·50 RM., postage extra, for each contribution to the discussion, up to July 1st, 1931. After that date the file copies of contributions to the discussion will be sent to the central office of the World Power Conference in London.

IT is reported that the system of signal lights for the control of traffic, which has been in operation at Ludgate-circus since July last, has proved so successful that the Commissioner of Police for the City has in mind its extension to other traffic points, but nothing definite has been decided. The temporary open stand at Ludgate-circus from which the constable on duty operated the signal lights has now been removed, and in its place a permanent kiosk which will give complete shelter to the officer on duty has been erected. The kiosk, a wooden structure with movable glass panels, is 11ft. 2in. in height. The control apparatus is under the floor or platform, which is 3ft. from the ground level, and which is reached by three foot irons or steps. The kiosk is of simple design and will be painted in two shades of green. A light green will be used inside and a darker shade for the exterior.

THE twin-screw motorship "Concepcion," built by A. and J. Inglis, Ltd., Pointhouse, Glasgow, to the order of the Argentine Navigation Company, London and Buenos Aires, has completed successful trials on the Firth and is now about to leave on her maiden voyage to Buenos Aires. As part of the trials the owners required a 600-mile continuous run, and this took place within the Firth of Clyde. This run was satisfactorily performed, and on completion the vessel was handed over to the owners. The new vessel is intended for passenger and cargo up-river service in South America, and is 200ft. long, 37ft. in breadth, and 8ft. 6in. in depth. The propelling machinery consists of two sets of six-cylinder Diesel engines, working on the Harland-B and W system. The "Concepcion" will, no doubt, maintain the high prestige which her builders have made for themselves in Argentina.

ON Sunday afternoon, January 25th, a power transformer, weighing 93 tons, was successfully moved from a railway truck in a siding at Deptford to the Deptford substation of the Central Electricity Board, where it will be installed. The transformer was made at the works of Ferranti, Ltd., at Hollinwood, Lancashire, and brought to London by train. At Deptford a special road truck on thirty-two pairs of wheels, drawn by two steam traction engines, was put alongside the railway truck and steel rails were laid to connect the two trucks. The transformer was then lifted by jacks to a sufficient height for it to be drawn by the traction engines along the rails to the road truck. Much attention was attracted by the enormous vehicle and load during the brief journey to the power station. The new transformer is designed to give an output of 60,000 kVA, at a working pressure of 132,000 volts. It will be installed on the site of the generating station built by Mr. Ferranti in 1891.

IT is reported that giant seaplanes, ordered and practically designed by Colonel Lindbergh, are being constructed by an American aircraft manufacturer for the three-day service of an international air line across the Atlantic which there is talk of initiating this summer or the late autumn, *viâ* Bermuda and the Azores. The aeroplanes are being built for Pan-American Airways. They will, it is estimated, be able to carry a cargo of 2000 lb. of mails, and cruise for a distance of about 2400 miles. The four engines, with a total of 2300 H.P., will be capable of driving the aeroplane at a speed of about 115 miles an hour. Pan-American Airways intends, it is reported, to use Consolidated Commodore flying boats on the leg from New York to Bermuda, and the Sikorsky seaplanes on the remainder of the route to London. Another plan under consideration, it is said, is to operate the Sikorsky flying boats as far as Lisbon, where British aeroplanes would pick up the mail loads and carry them to London. The Sikorsky seaplanes will be the largest aeroplanes ever constructed in the United States.

THE NAG HAMMADI BARRAGE ON THE NILE

MESSRS. COODE, WILSON, MITCHELL AND VAUGHAN-LEE, MM. INST. C.E., WESTMINSTER, ENGINEERS

(*For description see page 150.*)

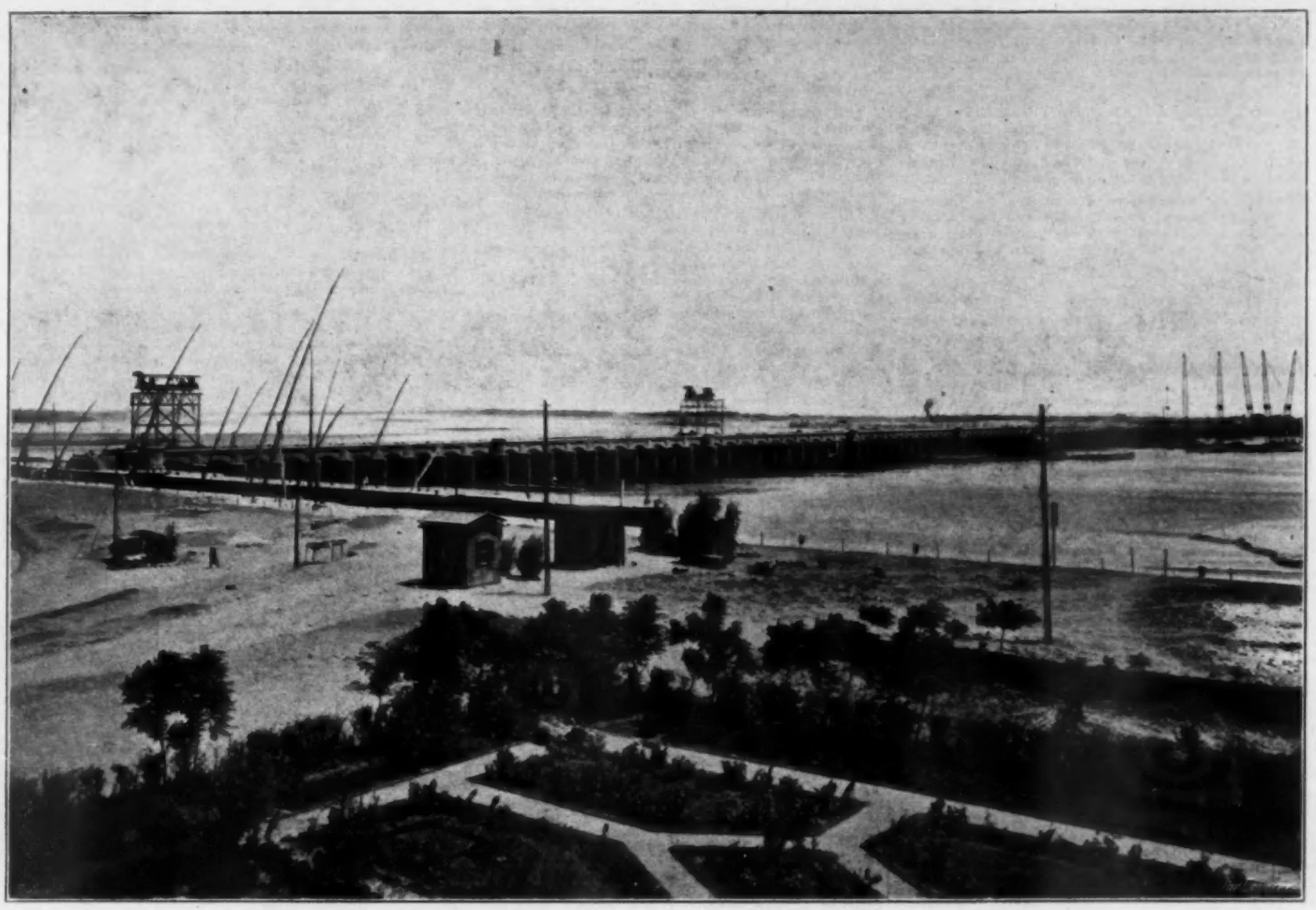


FIG. 18—UPSTREAM VIEW ON COMPLETION OF PIERS, JULY 1ST, 1930

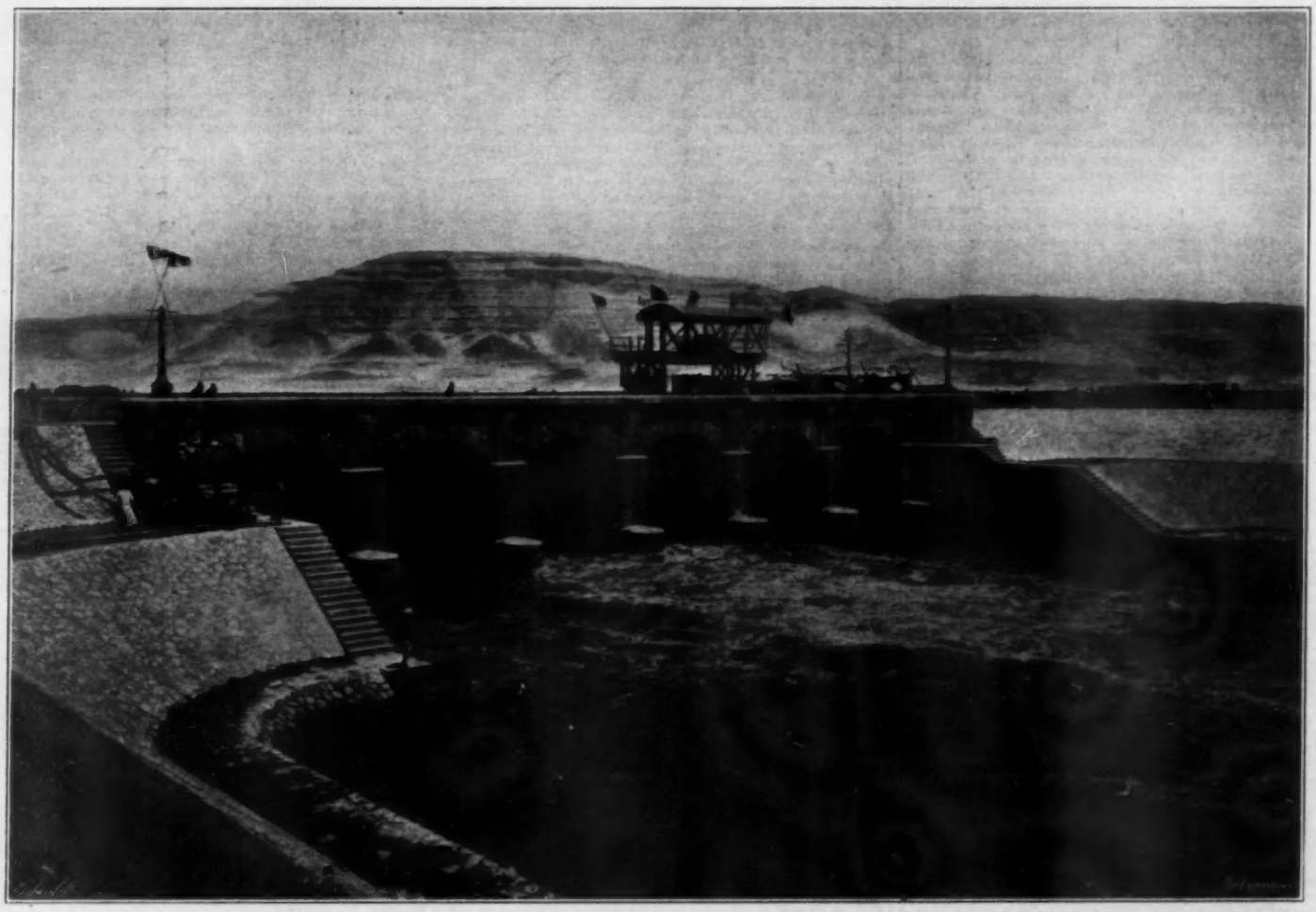


FIG. 19—THE FOUADIA CANAL HEAD REGULATOR—AUG. 25TH, 1930

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THE ENGINEER.

VOL. CLI No. 3917

FEBRUARY 6, 1931.

The Engineer and the Physicist.

LOOKING back to the beginnings of that industry as we know it to-day, it will be found that England developed its particular genius for engineering as a result of the efforts of a number of practical men. These men designed the machines they built without resorting to anything more theoretical than the rough estimations that they learnt, presumably, from studying the works of millwrights ; they knew from experience what a well-designed job should look like, and learnt by trial and error the limits of stress that could be applied to the materials they used. Such was their cleverness in the method of designing "by experiment" that England was soon world-famed for her engineering products. But such a method of design could not last ; many of the problems that faced the engineer could not be solved by experiment alone, so that as the use of machinery increased, and as new applications for it were found, a new class of engineers arose. These men began to apply calculation to help them to design their engines ; they experimented to find the laws of stresses and strains and the properties of the various materials they had to use. From the very first, those who followed in the steps of the older school sneered at the new scientific men, declaring that practice was the only thing that mattered in the training of the engineer. But slowly as scientific knowledge developed, it became obvious that practice was not everything. Nowadays a scientific technical education is regarded as an essential part of the training of an engineer. On the Continent the scientific part of the training appears to be considered more important than the practical, but in this country, influenced perhaps in part by the tradition handed down to us, we regard no engineer who has not had practical as well as scientific experience as fully educated. Indeed, though we believe that theoretical knowledge is a very valuable attribute, practical knowledge is thought to be even more important.

Now a further step in the entrance of science into engineering is adumbrated by the desire of the physicist to enter the ranks of the industry, either as a physical engineer or as a plain physicist. For some reason it has been thought, up till now, that the physicist has little in common with the engineer. It has been realised dimly that engineering, besides being applied mechanics, is also applied physics, but the argument has run that the application has very little to do with the physicist, although if the engineer chose to use any particular material—steam, for instance—the physicist could be called in to indicate to him its properties. The works chemist, on the other hand, was welcomed more or less cordially from the beginning, though it is difficult to see why he should be received and the physicist rejected. Perhaps it was because whilst the engineer was unwilling to admit that his physical knowledge could not be as great as that of the physicist, he admitted that he knew little about chemistry. Now the physicist is coming to the front, and already certain trades cannot carry on without him. In his presidential address to the Institute of Physics, which has just been published in pamphlet form, Dr. Eccles set himself to prove that industrialists in general throughout England would do well to place physicists on their staffs. To give point to his argument he showed the great extent to which wireless had been developed by the researches of physicists combined with the practical knowledge of engineers. Without attempting to underrate the importance of the engineer, he claimed that the physicist could give him very great aid. We freely admit that Dr. Eccles made out a strong case ; but at the same time we cannot help thinking that he took the one industry above all others that best supports his contention. The ordinary engineer deals with so many ultimate particles of matter at the same time that the curious behaviour of any small group of them is of no account. But the wireless engineer, on the other hand, is concerned with a number of particles which, though large, is infinitely smaller than that with which the ordinary engineer deals ; the behaviour of each small group, or even perhaps of each separate particle, is to him a matter of great importance. Who is more likely to be able to control the movements of these particles than the physicists ? But Dr. Eccles may be right in taking a long view, for, whilst the example he employed was one very favourable to his argument, no one can say what extensions physicists may ultimately effect in less obvious directions.

Science is extending so rapidly that no single man can hope to gain great knowledge in more than one or two subjects, but the engineering profession demands men capable of turning the ideas of scientists of any kind—physicist, metallurgist, or chemist—to practical uses. In the circumstances the engineer can choose between two courses. He can specialise in one subject besides engineering, and become a hybrid—a physical engineer, a chemical engineer, and so on. Or he can admit that he can never hope to have so great an understanding of their science as that of the physicists, metallurgists, and chemists, and devote himself entirely to a study of the best methods of applying the knowledge which the physicist and chemist give him. Whilst there must always be a small proportion of hybrids—have we not already an influential body of chemical engineers ?—it is certain that the great bulk of those who follow the profession of engineering will perforce limit themselves to the subjects proper to that profession. But if they are able to take the long view which Dr. Eccles has set before them, the time may not be far distant when the physicist will be found on the staff of engineering firms as frequently as the chemist now is. We are, indeed, already moving in that direction. Both in this country and abroad much of the work of research laboratories is physical rather than chemical, and the title "works chemist" is almost a misnomer. In the domain of pure physics there are indications, vague at present, but gaining substance, of an astounding future. To lift physical discoveries from the laboratories of great scientists and turn them to the direct benefit of man must be the work of the engineer, and the opportunity to do it holds out to the coming generation of those who follow our profession a delightful prospect.

Steel Castings.

So much attention has been paid of recent years to the fabrication of composite structures by means of welding that there is some danger of underestimating the rival possibilities of the steel foundry. The founder of cast iron can put up little resistance to the advance of newer processes, for, do what he will, his products must have the defects of the material he works with, and he therefore has to resign himself to seeing the forge, the plating shop.

and the welding shop encroach more and more on his ancient province. The steel founder, on the other hand, has not the same disability. He uses a metal closely similar in its strength and other properties to that which his rivals employ, and since his fashion of making a complicated part is a more direct process than theirs, his chance of, at least, holding his own in many fields should be a good one. Yet there can be no doubt that steel castings in the past earned for themselves a bad name, and have not quite lived it down. The machine shop still complains that they have hard spots, are not true to shape or size, or, worst of all, that a considerable number have to be scrapped owing to the discovery of blow-holes or porous places after a lot of expensive work has been done on them. Those concerned in the production of steel castings are generally ready to admit that there were grounds for dissatisfaction with their product a few years ago, but they maintain with a good deal of justice that things are better now.

That steel castings can be made better than they often are is undoubted, and once the average standard is raised, there should be much remunerative work for the steel foundry. Discussing their use for locomotive construction, Mr. H. R. Bartell, of the General Steel Castings Corporation of America, stated before the Engineering Institute of Canada that, in general, an integral cast steel structure could be made lighter than a built-up one for equal strength, and conversely for equal weight the single casting would be the stronger. For these reasons, makers of locomotives and rolling stock had largely turned from wrought construction to castings. The first important step in that direction was taken thirty years ago, with the introduction of cast steel side frames for the bogies of freight cars. The improvement was quickly introduced to passenger stock, and all new passenger bogies are now made of cast steel, and in most cases with the horn-blocks solid with the casting. Trailer bogies of modern locomotives are generally made of a single steel casting, often arranged to carry the booster engine. Tender frames, originally made of three steel castings bolted together, are now made of a single piece, and to get more water capacity the bottom of the water tank is formed by the same casting, a thin continuous web connecting the bottoms of the framing ribs. About 2000 tenders of this kind are now in use, some with water capacities as high as 18,400 gallons and with storage space for 30 tons of coal. Cast steel has been applied to the construction of the locomotive proper to an even more striking degree. The great 2–10–4 type locomotives of the Canadian Pacific Railway, which have to haul heavy trains over the Rockies, are made with frames and cylinders cast in a single unit, the casting being 55ft. 9in. long and weighing 66,500 lb. Even these are exceeded by the corresponding castings for the 4–12–2 locomotives of the Union Pacific, which carry three cylinders integral with the frame, and weigh 82,000 lb., with a total length of 60ft. 4in. There are now, according to Mr. Bartell, over a thousand locomotives with cast steel frames, and cast steel has even been applied to smoke-box construction. Work of this nature shows a highly developed technique in the foundries which have laid themselves out for it, and makes one wonder whether if equal skill and energy were devoted to the perfection of steel castings for other purposes, the steel foundry might not occupy with advantage a much more prominent position than it does. It would not take long to overcome the prejudice against steel castings if their quality were improved, and instead of engineers wondering how best they could avoid them, they would welcome the relief from many constructional difficulties which they would bring. Nobody, save in exceptional circumstances, would, for preference, cut up rolled plates and sections, and then rivet, bolt, or weld the pieces together again to make something, if he could attain his end as well, or better, by the use of a single casting.

Whenever an improvement is called for in any manufactured product, it is fashionable nowadays to cry out that "scientific research is needed." It would generally be more true to say that a little more practical common sense and enterprise were wanted. Mr. Bartell does not attribute the success of the locomotive steel founders to research of any kind; indeed, he expresses his belief that in steel founding generally too great emphasis has been laid on metallurgical matters. Sound steel castings depend, first, on the good engineering design of the part to be cast, and, secondly, on the practice in the foundry. A careful study over a period of years has, he says, indicated that most of the defects encountered either in the manufacture of steel castings or developed later in service could be eliminated by changes in design. It has also been found, he adds, that modifications to the manufacturing processes could prevent all but a slight percentage of the remainder. This we believe to be strictly true. It is not necessary for the designer to be able to interpret a photomicrograph and name correctly all the "ites" that may be present. But what he should know, and he cannot really gain the knowledge except by practical experience, is how hot steel behaves in the mould, and how it may be given the best chance of solidifying as a sound homogeneous piece of metal, of the form required, and free, as far as possible, from internal stresses. With the practical knowledge necessary to enable him to design castings in a way appropriate to the properties of the material, he can safely leave the rest to any steel foundry with capable moulders and intelligent direction. The heavy locomotive castings to which we have referred are not made from patterns, but the moulds are built up of hundreds of dry sand cores fixed so as to leave the required room for the metal to flow round them, and steadied by chaplets which remain in the casting. It is, indeed, an elaboration of a method of moulding wheels which is sometimes practised in the ironfoundry. To adapt it successfully to the manufacture of complicated castings over 60ft. in length, which have to be accurate to shape and size, in spite of the great and variable contraction which occurs at different points, is no mean achievement. It was certainly not the work of a day, and equally surely it was not arrived at without innumerable discouragements; yet it is only twelve or thirteen years since a cast steel frame was fitted to a locomotive of any kind. The rapidity of the progress serves to show that, formidable as the troubles may have been, they must have been overcome almost as soon as discovered. This should be a good augury for those who would like to see the average steel foundry of greater service to engineering than it is to-day, whether regarded from the standpoint of the variety or the quality of its products.

Literature.

Physical Science of Flour Milling. By E. D. SIMON, M.A., M. Inst. C.E., M.I. Mech. E., M.P. Liverpool: The Northern Publishers Company, Ltd. Price 10s. 6d.

THIS book deals with the principles of flour milling engineering and the physical science underlying the design of the machinery necessary to clean the wheat berry and to split it up into the desired products. It has grown out of three papers read by the author before the National Association of British and Irish millers on "The Power Required to Drive a Flour Mill," in 1913; "The Principles of Wheat Conditioning," in 1923, and "Flour Milling Research," in 1928. The author states in the preface that although astonishingly good results are being obtained from modern milling machinery, there is plenty of room for further development as the knowledge of the principles underlying milling engineering is very incomplete. As most of our readers are aware, the introduction of the roller mill and the automatic gradual reduction system between 1880–1890 revolutionised flour milling, and during the last half century there have been three further main developments. First, the introduction of washing and conditioning, with the scientific control of the moisture content; second, the lengthening of the roller surface and improved classification and purification of the stocks, and third, the employment of chemical substances for bleaching and strengthening the flour. Mr. Simon states that the provision of the above means can be valued by the miller at 2s. 6d. per sack of 280 lb., which figure has to be set against the increased capital outlay. The field for further development embraces methods of cleaning the wheat, which, at present, costs about 8d. per 280 lb. of flour and, therefore, does not leave a very large margin for saving; but mechanical separation and milling, which cost altogether about 2s. 9d. per sack, should be worth further attention on the part of inventors.

The existing processes for separating the materials are very fully dealt with in Chapter II., which will be found highly interesting. There are three main principles involved in separating: First, according to the dimensions of the material; second, by specific gravity, and third, by the resistance offered by the different particles to the passage of an air current. All these methods are described very fully with the aid of diagrams. The collection of dust is another branch of the subject, which the author deals with very thoroughly. He describes the two chief methods in use, namely, the collection of dust by means of centrifugal force, as in the well-known "Cyclone" system, and filtering the dust-laden air through a textile medium. The suction filter is said to be most efficient for flour mills, while the cyclone has the advantages of initial cheapness, simplicity of working and low running costs.

There are also chapters devoted to conditioning, which includes the absorption of moisture, drying and cooling of the wheat to improve its physical condition to facilitate milling operations—and purification, the object of which is to prepare the stocks for the reduction roller mills by freeing them from branny particles. Further chapters give an analysis of the power required to drive a flour mill, and a record of tests of the power consumed by various machines in roller flour mills. In an example quoted by the author the break rolls consumed 26·15 per cent., the smooth rolls 33·87 per cent., the scalping and dressing machinery 21·53 per cent., the purifying machinery 7·02 per cent., the shafting 6·19 per cent., and the balance of 5·22 per cent. of the whole was absorbed by the worms and elevators. The whole plant absorbed 7·8 horse-power per sack of flour produced.

A commendable feature of this excellent publication is the entire absence of matter which can be regarded as an advertisement for any particular makers of the machinery described.

The Technical Arts and Sciences of the Ancients. By ALBERT NEUBURGER. Translated by HENRY L. BROSE. London: Methuen and Co., Ltd. 1930. Price 42s.

THE title of the German original of this book is "Die Technik des Alterthums," which might be literally translated as "The Technology of Antiquity." Dr. Brose has expanded it into the form given above in order to make the scope of the work more obvious. Dr. Neuburger was a collector, and his volume is, in fact, a collector's note-book. He drew information from a great variety of sources, and set down what he found without, as far as we can see, any attempt to make a close critical examination of its accuracy, or, in some cases, of the real meaning. But in the original a full bibliography is given and all those who were scientifically interested could therefore turn to the sources from which he drew and make their own deductions. Dr. Brose has omitted the bibliography, and in so doing has reduced the value of the work to the serious student of archæology.

Hence the English version, losing some of the character of the German, is rather disappointing. It is now an interesting work for the casual reader, rather than one to which the seriously minded will turn for carefully analysed information. But it is not without its attraction. It is copiously illustrated and no one who even carelessly turns over the pages can fail to be impressed by the remarkable technical progress that had been achieved in the ages to which we give the very indefinite term—ancient. In Dr. Neuburger's hands that period extends from a few hundred years B.C. to a few hundred A.D., though he draws some of his examples from Egyptian records which go still further back. The geographical scope of the work is also limited, Dr. Neuburger confining his attention almost solely to the Near East, the technology of the ancients of America, China, India, and even of Western Europe being almost neglected. Indeed, the sources upon which he draws are, by a great majority, Greek, Roman, and Egyptian.

Regarded as a whole, the volume must be looked upon as a popular rather than a scientific work. But that is not to assert that it is without value. Whilst it would be untrue to say that the general public is unaware of the technical progress attained by the ancients—a visit to any good museum corrects at once mistaken views on that subject—it cannot be doubted, in the first place, that still greater knowledge expands the mind, and, in the second, that such matters have a peculiar attraction. Hence, within its limitations, we may welcome Dr. Brose's translation.

SHORT NOTICES.

Construction Joints in Concrete: Bonding New Concrete to Old. London: H.M. Stationery Office. 1930. Price 2s. net.—This is Special Report No. 15 of the Building Research Board of the Department of Scientific and Industrial Research. It gives an account of investigations made by Mr. Norman Davey at the Building Research Station at Garston, Herts., into construction joints in concrete, and it includes, also, information on the subject collected from available literature. It is divided into an Introduction and nine parts. Part I. explains how the experiments were carried out. Part II. discusses the disadvantages of improperly made construction joints, while Part III. sets out the factors reducing the efficiency of bond at construction joints. Part IV. describes the preparation of the surface of old concrete in readiness for bonding on new concrete, and Part V. the application of new concrete to that prepared old surface. "Durability of Joints," "Bonding Different Types of Cement," and "Location of Joints," form the subjects of Parts VI., VII. and VIII. respectively, while Part IX. embodies a summary of the foregoing. The volume is illustrated with a number of excellent reproductions on art paper, of half-tone engravings—the majority of them being from photo-micrographs. It also contains many useful hints and bits of information.

Compressed Air Plant. Fifth edition. By Robert Peele, London: Chapman and Hall. 1930. 37s. 6d.—This book, which was first published in 1908, has now again been brought up to date in its fifth edition. It has been found necessary, so great have been the changes in the past few

years, almost to re-write the whole book, but it has not lost its character in the process and still remains an invaluable treatise and reference book on everything in connection with compressed air. After touching lightly on the history of the subject, the author gives an outline of the theory of air compression, and in succeeding chapters deals in detail with the production of compressed air and compares and describes the various types of machines. The second part of the book is devoted to methods of transmission and the uses to which compressed air can be put. The volume is fully illustrated throughout by drawings and photographs, while many graphs and nomograms are given. Tables of figures of all points of interest are included. The book has proved itself in the past to be most useful to students and engineers alike; in its revised form it should be no less useful.

The Manufacturing Industries of the British Empire Overseas. Part I.: Canada. Part II.: Australia. By Harold H. Carvalho. Published by Erlangers, Ltd., Bankers, 4, Moorgate, E.C. 2. Price 2s. 6d. each part.—The purpose of these folio pamphlets is best described by the extraction of a few sentences from the introduction to the first. "No topic excites more interest at the present time, both in the United Kingdom and abroad, than the question of the future fiscal policy in Great Britain. Few people are so optimistic as to be satisfied with the existing state of affairs in this country. Each school of thought is apt to prescribe its own formula compounded with drugs which are described as stale or too potent, according to the point of view of the opposing faculties. We propose to lay before our readers a series of articles which shall be completely remote from politics, but which, we hope, will throw new light on some aspects of these questions . . . the object of this series of articles is to place before our readers information as to the manufacturing industries now developed in the British Empire overseas." The information which is set forth in text, tables and graphs, is drawn from official sources, but the busy man who has not time to make analyses himself, will value those prepared for him by Mr. Carvalho. In Part I.: Canada, the engineering and cognate industries take a more important place than in Part II., which is devoted to Australia, but in both the facts are presented in a manner which makes reference easy, and those of our readers who are interested in Dominion trade will find them invaluable. We welcome the two parts already produced, and look forward to the publication of the remainder.

Craftsmen's Measures in Prehistoric Times. By Ludovic MacLellan Mann. Glasgow: The Mann Publishing Company, Ltd. 1930. Price 2s. 6d.—In this pamphlet the author sets out the thesis that man in prehistoric times chipped his flints to recognised standard dimensions and that the old French foot of 14·85in.—one-fifth of the *aune*—was the direct lineal descendant of Stone Age Measures. By means of a number of diagrams the author shows that a large percentage of objects measured by him conformed in their principal dimensions to a few definite scales. Whether the recurrence is fortuitous or intentional, we are not prepared to say, but, whilst admitting the possession of no expert knowledge, we confess our incredulity.

BOOKS RECEIVED.

Sea Power. By G. Drage. London: John Murray, 50, Albemarle-street, W. 1. Price 10s. 6d. net.

List of Publications, Bureau of Mines, 1910–1930, Washington, D.C.: Section of Publications, Bureau of Mines, U.S.A.

Inhalt Verzeichnis der Zeitschrift Maschinenbau, 1918–1928. Berlin: V.D.I. Verlag G.m.b.H., Douthcenstrasse 40, N.W. 7.

The Salt Industry of Canada. By L. Heber Cole. Ottawa: Mines Branch, Department of Mines, Canada. Price 20 cents net.

Motorshipping in 1930. By A. C. Hardy, F.R.G.S. London: The Journal of Commerce, 14–20, Bishopsgate, E.C. 2. Price 15s. net.

Clubs, 1931. Edited by E. C. Austin Leigh, M.A. London: Spottiswoode, Ballantyne and Co., Ltd., New street-square, E.C. 4. Price 7s. 6d. net.

Slide Rule Calculations. By H. O. Cooper. London: Humphrey Melford, Oxford University Press, Amen House, Warwick-square, E.C. 4. Price 7s. 6d. net.

Sydney Harbour Trust Commissioners' Thirtieth Annual Report for the Year ended June 30th, 1930. Sydney, N.S.W.: The Sydney Harbour Trust Commissioners.

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Economic Conditions in China. Report by E. G. Jamieson, C.B.E. With an Annex on the Trade of South Manchuria. By W. B. Cunningham. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 2s. 6d. net.

AT Ancona in the district that suffered most from the earthquake of October 30th, the first group of earthquake-resisting houses built under the direction of the civil engineers with funds supplied by the Government has been opened. The houses are little villas of four rooms each, with gardens.

Electrification in Sweden.

WRITING in the Svenska Kreditaktiebolaget's quarterly review, Monsieur G. Malm, Director-General of the Waterfall Board, says that one of the principal factors in the extensive industrial development of Sweden during the present century has been the abundant supply of water power. With the exception of Norway, no country in Europe is more favoured in that respect. The water power in Sweden which can be practically utilised and which is available all the year round is estimated at about 9,000,000 H.P. In 1929, the total production of electric power in Sweden was about 4,850,000,000 kWh, which is equivalent to about 800 kWh per head per annum. In Europe that figure is surpassed only by Norway and Switzerland. Roughly, 96 per cent. of the total output of electric power is derived from water-power stations, the remaining 4 per cent. from steam-power stations.

Fairly satisfactory natural reservoirs for the equalisation of the water supply are generally provided in Sweden by the watercourses themselves, but considerable improvements can be effected by means of water storage in lakes, for which, as a rule, natural conditions are favourable. Several enterprises of this kind, some of them on a large scale, have already been carried out, and the regulation of the water discharge from Lake Vaener, above the Goeta River, which is now being planned, would be an enterprise that would considerably increase the output of power for State requirements in Central Sweden and Lower Norrland.

In 1929, the consumption of water power for various uses was approximately as follows:—

	Per cent.
Timber, paper and pulp industries	40
Iron industry and mining	13
Mechanical, textile and miscellaneous industries	6
Electro-thermic and electro-chemical industries	23
Public consumption in towns and large urban communities, inclusive of small industries and crafts	7
Countryside	5
Electrified railways and tramways	6

The above figures, which show that the big consumers are the large industries, illustrate the importance of water power for the industrial development of the country. But if should be borne in mind that the low percentages of the consumption of power for public purposes and in the countryside do not indicate inadequate electrification of houses and farms, but are due to the immense consumption of power by the big industries. Indeed, it may be said that in Sweden electric power is consumed for public requirements on a comparatively large scale.

As regards the use of electricity for the driving of railways, the State Railways, as already reported, encouraged by the success of the electrification of the Lulea-Riksgraensen and Stockholm-Gothenburg lines, are planning the electrification of the southern main line and certain branch lines connecting it with the western main line. After those extensions the principal State railway lines will be independent of imported fuel.

The large scale on which water power has been used in Sweden has, naturally, affected imports of fuel, as appears from the following figures:—

	Average for 1910–14.	Average for 1925–28.
Steam coal in millions of tons	3·7	3·4
Fuel oil in thousands of tons	10·8	79·5
Illuminating oil in thousands of tons	109·1	63·9

Attention is drawn to the stagnation in imports of steam coal in spite of the immensely increased use of machinery, and the striking decrease in imports of illuminating oil. The big rise in imports of fuel oil is, doubtless, chiefly due to the immense development of motor traffic, &c.

The biggest power producer is the State. By connecting together its water power plants on the Goeta-aelv, Motalastroem, and the Dal-aelven and its big steam plant at Vaesteraas, it has created an immense aggregate of power, the so-called "central block" in the heart of Sweden. The State also owns two main systems of power lines in the northern part of Sweden. In 1929, the aggregate output of power from the State power lines was 1,690,000,000 kWh, or about 35 per cent. of the entire amount of power produced in Sweden. In the southernmost part of the country, Sydsvenska Kraft AB., in which certain municipalities are the principal shareholders, holds a dominant position, its output for 1929 being about 334,000,000 kWh. The City of Stockholm, which produces its own power, has an annual consumption of 236,000,000 kWh.

The supply of water is very unevenly distributed in Sweden, being most abundant in Norrland, while the southern part of the country is by no means so well provided for in this respect. But, as the population is much denser in the South of Sweden, the demand for power is much greater there than in the North, and it is only natural that the water power in the more densely populated southern part of the country should have been exploited first. All the utilisable water power there will soon have been developed, and it will be necessary to transmit power from the North of Sweden southwards in order to meet the increasing demand.

The Waterfall Board, which has acquired an abundant supply of natural water power in Lower Norrland and has at its disposal water power resources in Upper Norrland, contemplates the eventual laying of lines to bring power from Norrlandt southwards, at the same time connecting its northern system with the "central block." The State, however, has not a monopoly of such schemes. The Kraangede Company, formed by interested parties in the mining district and the City of Stockholm, intends within the near future to develop the very large Kraangede Falls on the Indalsaelven and conduct power down to Central Sweden.

These two enterprises require large amounts of capital. It is hoped, therefore, that the parties will endeavour to work the new links into the existing system for the supply of power in such a way that the greatest benefit may accrue to the country as a whole. This is one of the most pressing questions in connection with the supply of power in Sweden.

SIXTY YEARS AGO.

"PEOPLE can hardly be brought to understand that engineering can accomplish almost anything when the financial sinews are supplied with sufficient liberality." So wrote our Scottish correspondent in our issue of February 10th, 1871. He was referring to the doubts expressed by many people concerning the practicability of throwing a bridge across the Tay at Dundee. Why there should have been any doubts on the subject we can now only guess. Yet that there was not only doubt, but foreboding, our correspondent specifically stated. The construction of the bridge at that date had barely been begun. Nothing more had been done than to take soundings and make borings in the bed of the river to ascertain the depth of the rock on which the foundations were to rest. Even already, however, trouble had arisen with the contractors. A new contract had been entered into with a London firm—Deborg and Co.—which undertook to execute the work for some £12,000 less than the sum involved in the original contract. The total cost of the bridge, our correspondent stated, would be about £217,000. Messrs. Deborg, he reported, intended to proceed by sinking immense iron cylinders into the bed of the river by means of a digging or scooping machine working inside the cylinders, which would gradually sink until they reached the rock. The bridge would consist almost entirely of iron and in that respect the contractors were favourably situated by reason of the fact that they had an extensive foundry in Wales. It, no doubt, seemed to our correspondent and many others that the bridge was to be constructed with all the latest resources of engineering science at the disposal of the builders, and that the "financial sinews" were being supplied with great liberality. Yet, looking back, we know now that the commonly expressed forebodings of the uninformed were more justified than the boasts of those who claimed that "engineering could accomplish almost anything." Further trouble was to develop with the contractors and six years were to elapse before the bridge was completed. Sir Thomas Bouch's design stood the test of service for two years. Then came the wild night of December 28th, 1879, the collapse of 3000ft. of the bridge and the hurling to death of a hundred persons.

THE IRON AND STEEL INSTITUTE.

AMERICAN MEETING, SEPTEMBER, 1932.

THE Iron and Steel Institute has received a cordial invitation from the American Institute of Mining and Metallurgical Engineers and the American Iron and Steel Institute to hold its 1932 Autumn Meeting in the United States. The meeting is expected to take place under the presidency of Colonel Sir Charles Wright, Bart., K.B.E., C.B.

As the Institute of Metals has likewise received an invitation from the American Institute of Mining and Metallurgical Engineers to hold its Autumn Meeting in America at the same time, it is considered that it will be to the mutual convenience of both Institutes to make joint arrangements as far as possible for ocean travel and for inland travel in America, independent arrangements being made for the technical meetings. The excursions to works are expected to be available within limits to members of either Institute.

A provisional Committee of Organisation, consisting of the following gentlemen, Mr. H. Foster Bain, Mr. E. A. Clarke, Dr. P. D. Merica, and Dr. J. V. W. Reynders, has been formed at New York to prepare plans for the reception of the visitors, Mr. H. Foster Bain, secretary of the Am. Inst. M.M.E., acting as hon. Secretary. The inclusive dates for the technical meetings and excursions have tentatively been agreed upon as Monday, September 12th, to Thursday, September 29th, 1932. As at present arranged the main party will leave Southampton by Cunard liner on September 3rd, and the itinerary, starting from New York, includes Washington, Pittsburg, Detroit, Cleveland, Chicago, Niagara, Toronto, and Montreal, with alternative visits to Duluth and Algoma. Members will reach London on the return journey on October 8th.

Plans are under consideration for participation in some form by the Canadian Institute of Mining and Metallurgy, either at Toronto or Montreal, or both.

An inclusive charge will be quoted for ordinary first-class accommodation on the steamer, for Pullman car accommodation in America, and for hotels in New York and elsewhere. This inclusive charge may be expected to amount to about £125 for the round journey from London back to London, and for those desiring superior accommodation on the liners and on the special train, an additional charge will be made according to the class of accommodation required.

THE Argentine Minister of Public Works has received an encouraging report from the engineering staff which was charged with the study of hydraulic power and the cost of transmitting electric power to the capital and nearby towns. Among the sources reported upon are the Apipe Rapids and the Salto Grande and Iguasú Falls. During 1930 the installed capacity of generating equipment supplying the Federal City and surrounding districts exceeded 400,000 kW, and it is estimated that the growth of demand for power will render substantial additions necessary before long. The potential power to be conveyed by lines from sources within an area of 32,000 square kilometres is cautiously estimated at 2,000,000 H.P., but other important untouched sources exist in the Rio Negro Territory, particularly in the Cordillera region between San Martin de Los Andes and Colonia 16-de-Octubre. At Buenos Aires the consumption of electricity has steadily increased of recent years, and now exceeds 550,000,000 kWh, an increase of 138,000,000 kWh since 1925. Public consumption absorbs 45,000,000, light 160,000,000, and power and traction 345,000,000 kWh.

High-Pressure Locomotives.*

By H. N. GRESLEY, C.B.E., Member of Council.

(*Concluded from page 141.*)

Four-cylinder, High-pressure Compound Locomotive, London and North-Eastern Railway.—The first British high-pressure locomotive to be built is the four-cylinder compound engine of the London and North-Eastern Railway, which was completed at the end of 1929. Unlike his continental collegues, the author, in designing this engine, thought it advisable to be content with what may be regarded as only a moderate increase in boiler pressure to 450 lb. per square inch. In coming to this decision he was largely influenced by consideration of maintenance costs and the desirability of advancing by stages. Past experience of revolutionary designs has been that the spectacular advancements have not always been justified by results, and, consequently, the author, deemed it wiser to seek progress on a less ambitious scale. He also recognised that as the pressure increases, the economies to be expected in fuel consumption are in a diminishing ratio.

He decided to adopt a boiler of the water-tube type, in view of the successful application of such boilers to high pressures in marine practice and in large power stations. In September, 1924, he accordingly approached Mr. Harold Yarrow, of Glasgow, whose firm are so well known as designers and builders of water-tube boilers, and suggested to him a design of boiler of the water-tube type which might be applied to locomotives. A water-tube boiler suitable for a locomotive involves a radical departure from the usual design of such boilers for marine and land purposes, and upwards of three years' of work on the part of Mr. Yarrow and the author resulted in the completion towards the end of 1927 of the final design, which was patented in their joint names. Early in 1928 an order was placed with Messrs. Yarrow to proceed with the construction of the boiler, which was completed and tested in October, 1929. The engine was built at the Darlington Works of the L. and N.E.R., and ran its trial trip on December 12th, 1929.

The drums of the boiler are of sufficient diameter to allow a man to get inside them for the purpose of expanding the tubes. To suit the conditions peculiar to a locomotive, it was felt that tubes of a large diameter only should be used, the tubes in the fire-box end of the boiler being 2½in. external diameter and the tubes in the forward part 2in. Fig. 9 gives cross-sections of the boiler,† and in the accompanying table the leading particulars of the engine are set forth.

The considerations which govern the design of marine and land boilers are so entirely different from those required in a locomotive boiler, that there is very little similarity between the boiler used on this engine and the ordinary type of water-tube boiler, as will be seen from Fig. 10.

In the ordinary water-tube boiler resting on foundations, the boiler can expand freely in any direction, and the tubes, not being subjected to vibration and racking stresses, are not liable to leak. In a locomotive, the boiler must be so secured to the frame that, in addition to standing the shocks and vibrations consequent upon the engine running at high speed upon a railway, it must be capable of withstanding shocks which occur when a locomotive is shunting, or comes in contact with buffer stops, or, possibly, becomes derailed.

It is necessary also to have due regard to the fact that the boiler provides an important structural element in the construction of a locomotive and contributes to its rigidity. It will be seen from the diagram that in this boiler the large steam drum forms the backbone of the boiler, from which the tubes and the small drums depend. At the forward end this drum is carried in a cast steel cradle, into which it is firmly secured by large strap bolts, and any fore-and-aft movement is entirely prevented by stops, which are machined on the lower side of the drum. The cradle in turn is secured to the engine frame by 1in. steel plates extending downwards inside the main engine frames, to which they are securely riveted. The steel drum must be free to expand longidudinally, and accordingly the back end is secured to the top of a triangular-shaped transverse plate which, in turn, is secured at its lower extremity to the engine frame. The drum, therefore, whilst being free to expand longitudinally, is constrained from side or vertical motion.

The four smaller drums are not supported, but hang from the water-tubes. Rectangular lugs are riveted to the lower side of each of these drums at their forward and back ends. These rectangular lugs are free to slide longitudinally in grooved castings, which are secured to the engine frame; but as they do not reach the bottom of the grooves, they are also free to move vertically. These lugs and grooves are provided to restrain the drums from any side movement. It was considered that this was the

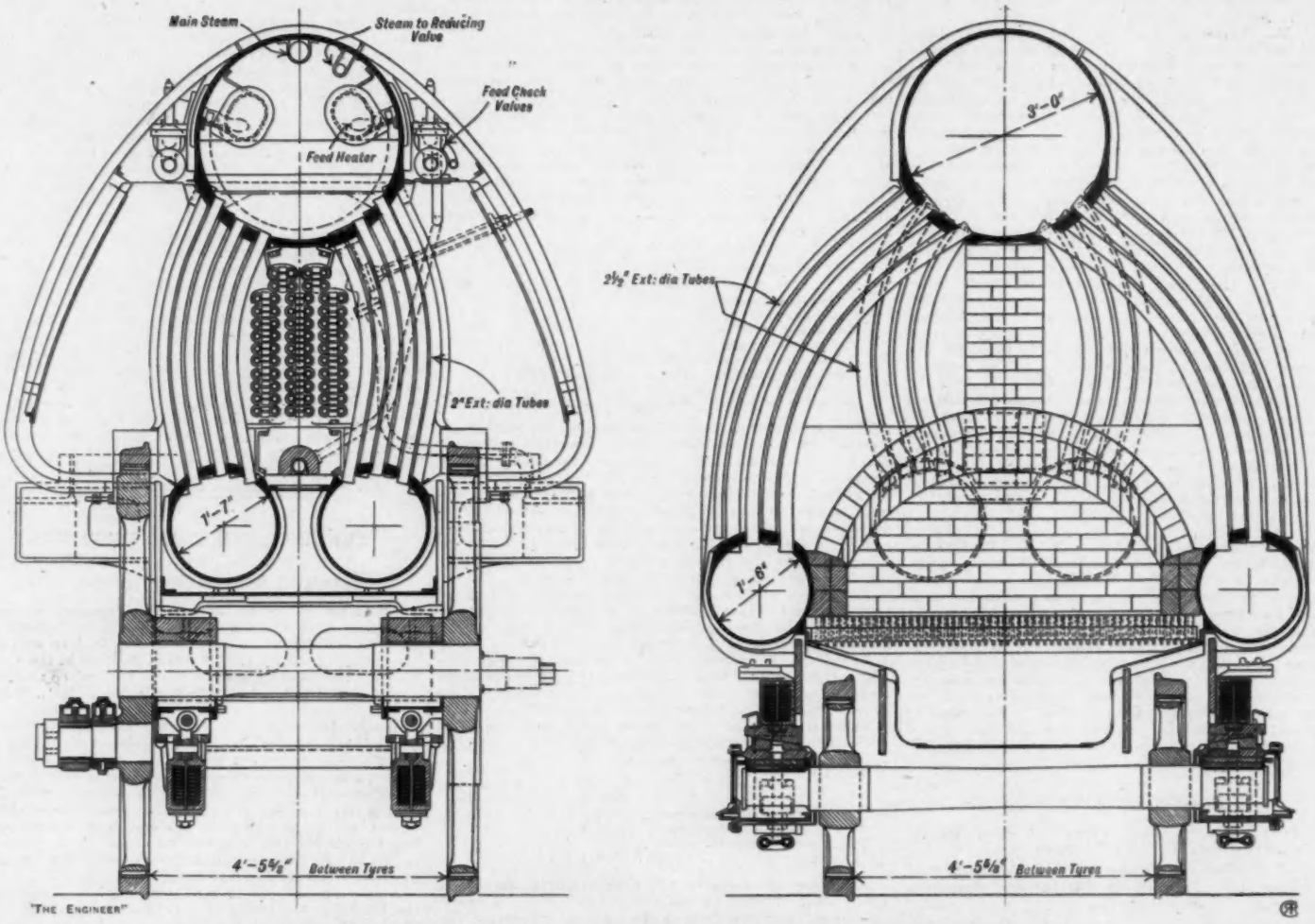


FIG. 9—CROSS SECTIONS OF YARROW-GRESLEY HIGH-PRESSURE LOCOMOTIVE BOILER

Four-cylinder High-pressure Compound Locomotive, London and North-Eastern Railway.—Leading Dimensions and Ratios.

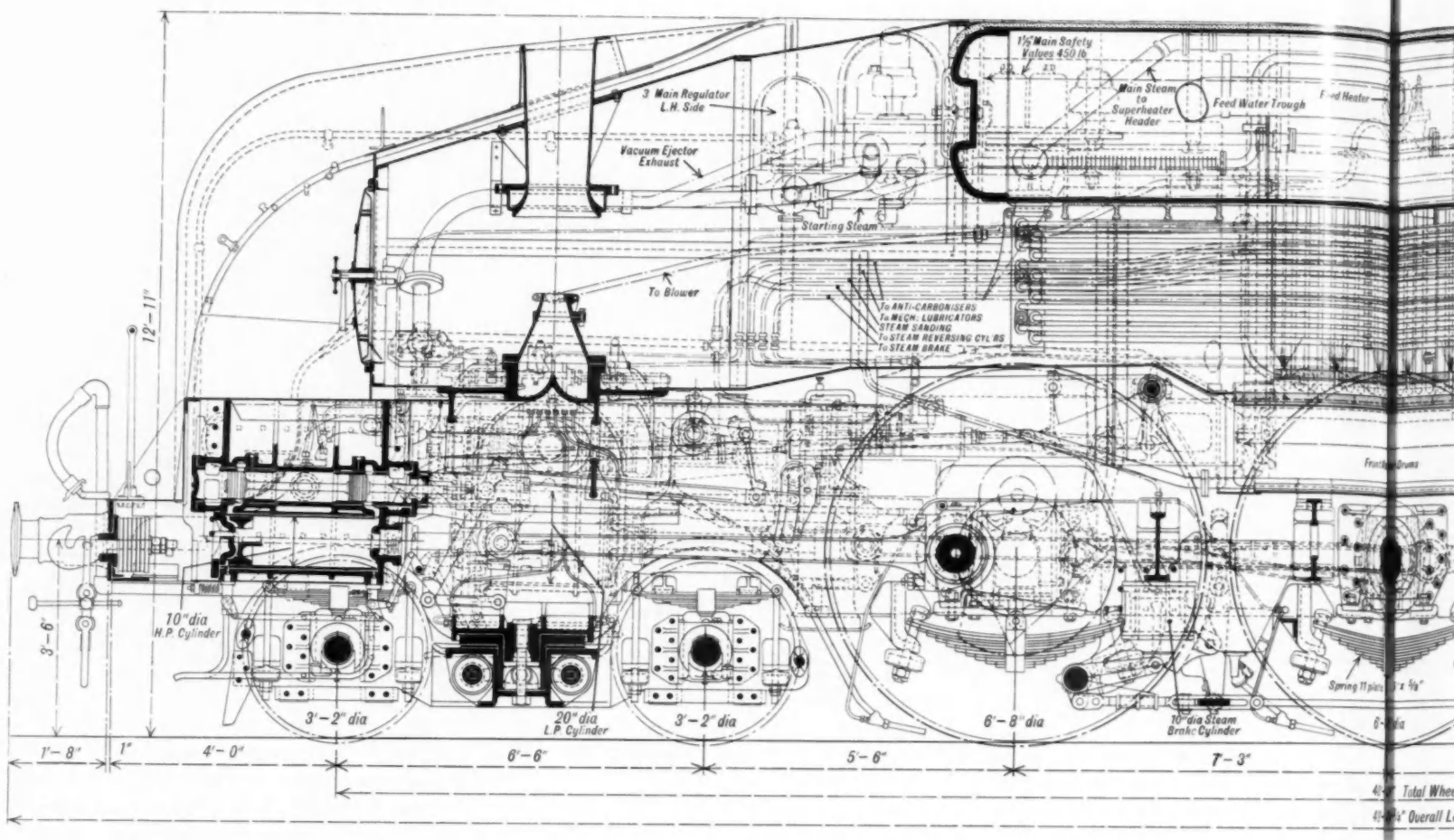
Grate—	
Length on slope	7ft. 6in.
Width	4ft. 8in.
Grate area	34·95 sq. ft.
Boiler—	
Steam drum :	
Length	27ft. 11½in.
Diameter inside	3ft.
Water drums, forward :	
Length	13ft. 5½in.
Diameter inside	1ft. 7in.
Water drums, back :	
Length	11ft. 0½in.
Diameter inside	1ft. 6in.
Smoke-box length	16ft. 1in.
Working pressure	450 lb. per sq. in.
Tubes—	
Small :	
Number	444
Diameter outside	2in.
Combustion chamber :	
Number	74
Diameter outside	2½in.
Fire-box :	
Number	250
Diameter outside	2½in.
Heating surface—	
Fire-box	919 sq. ft.
Combustion chamber	195 sq. ft.
Small tubes	872 sq. ft.
Total evaporative	1986 sq. ft.
Heating surface (continued)—	
Superheater—	
Number of elements	12
Diameter inside	1·18in.
Heating surface	140 sq. ft.
Total heating surface	2126 sq. ft.
Axles—	
Journals :	
Bogie	6½in. × 11in.
Coupled wheels	9½in. × 11in.
Carrying wheels	6in. × 11in.
Bissel wheels	6½in. × 11in.
Crank pins—	
Outside	5½in. × 6in.
Inside	8½in. × 5½in.
Coupling pins—	
Leading	4in. × 4½in.
Driving	6in. × 4½in.
Trailing	4in. × 4½in.
Springs—	
Bogie wheels :	
Type	Laminated
Length	2ft. 6in. centres
Number of plates	8
Size of plates	4½in. wide × ⅞in.
Coupled wheels :	
Type	Laminated
Length	3ft. 6in. centers
Number of plates	11
Size of plates	5in. wide × ½in.
Springs (continued)—	
Carrying wheels :	
Type	Laminated
Length	4ft. 6in. centres
Number of plates	10
Size of plates	5in. wide × ½in.
Bissel :	
Type	Helical
Outside diameter	5½in.
Free length	10 5/8 in.
Cylinders—	
High-pressure	(2) 10in. × 26in.
Low-pressure	(2) 20in. × 26in.
Motion—	
Type	Gresley-Walschaert
Valves :	
Type	Piston
Diameter, H.P.	6in.
Diameter, L.P.	8in.
Maximum travel, H.P.	8 5/8 in.
Maximum travel, L.P.	6 5/8 in.
Steam lap, H.P.	1¼in.
Steam lap, L.P.	1½in.
Exhaust lap	Nil
Cut-off in full gear, H.P.	90 per cent.
Cut-off in full gear, L.P.	75 per cent.
Tractive effort	32,000 lb.
Total adhesive weight	140,000 lb.
Adhesive weight ÷ tractive effort	4·37
Brakes	Steam brake and vacuum ejector

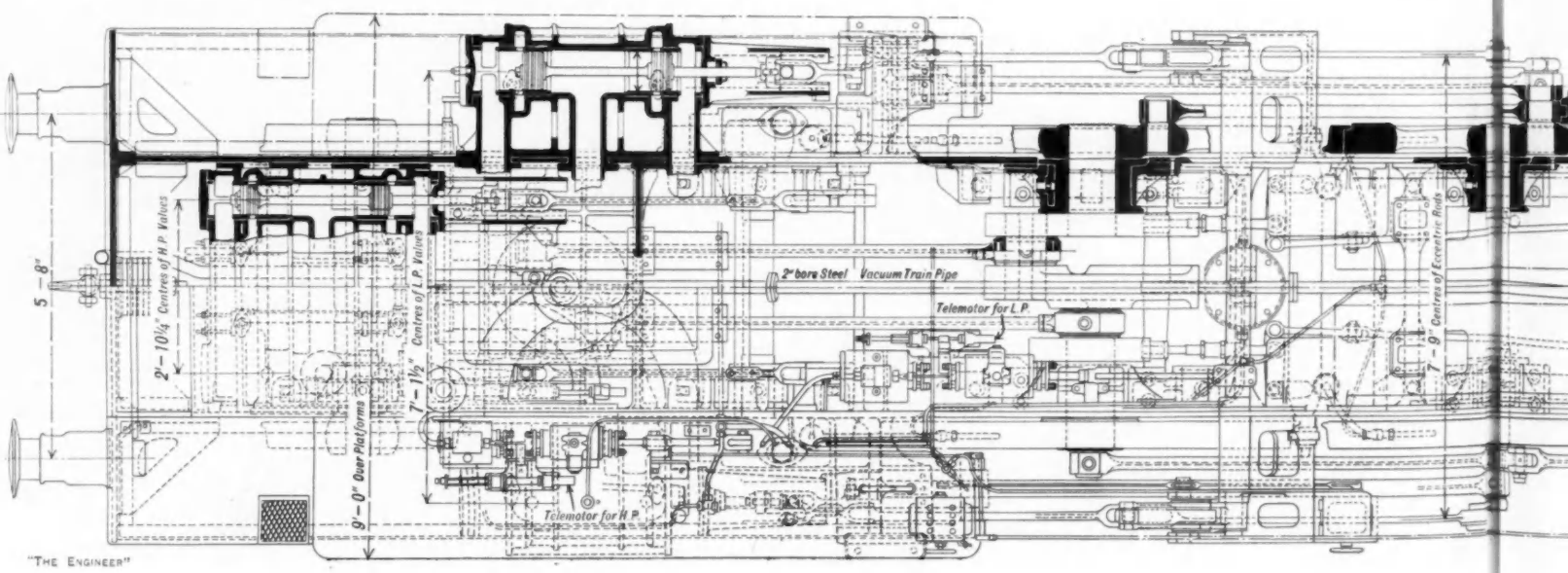
* The Institution of Mechanical Engineers.

† In our Two-page Supplement we give a general elevation and plan of the engine.—ED. THE E.

HIGH-PRESSURE FOUR-CYLINDER COMPOUN

MR. H. N. GRESLEY, M. Inst. C.E., M.

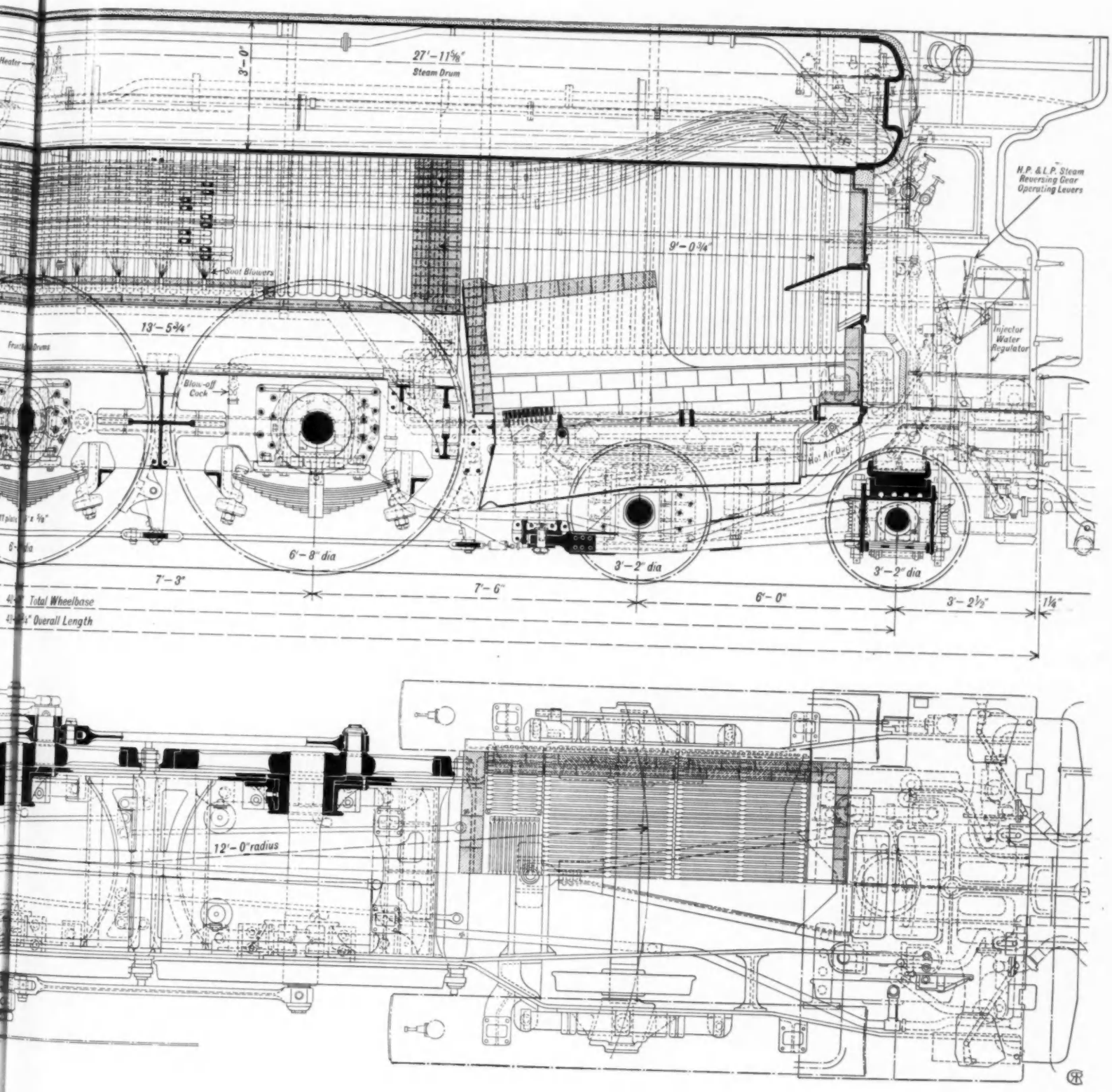




"THE ENGINEER"

OMPOUND EXPRESS LOCOMOTIVE NO. 10,000

M. Inst. E., M.I Mech. E., ENGINEER



best way of preventing the transmission of vibration and shocks to the tubes in such a way as might cause leakage. It is interesting to note that this method of construction has been completely successful, in that there has been no case of the slightest leakage occurring at any of the 1536 points at which the tubes have been expanded in the drums.

In adopting a water-tube boiler, the author was not unmindful of the troubles which might reasonably be expected to result from scale formation in the tubes. Unlike marine and power-house boilers, in which the boiler feed is derived from the condensate and only a very small make-up of fresh water is required, the locomotive boiler requires 100 per cent. of make-up water. In order to prevent the formation of scale as far as possible, the author decided to introduce the feed water at the highest possible temperature. The feed water is introduced into a chamber at the forward end of the top drum in front of the water-tubes and separated from the evaporative portion of the boiler by a weir at a height of about half its diameter.

The water is supplied from the tender by means of two ordinary injectors, and is delivered into this forward space of the top drum, after passing through a form of injector heater. The latter has two sets of cones in which the injector action is repeated by steam from the steam space in the boiler. Heat is absorbed to such an extent by the feed water that its temperature when delivered into the water chamber is over 400 deg. Fah., and is, therefore, only about 50 deg. less than that of the saturated steam in the boiler. Much of the scale and mud is, consequently, thrown down in the forward portion of the top drum.

But for this arrangement for dealing with the feed water, considerable trouble due to the formation of scale would have to be expected; as it is, after running some 15,000 miles, a slight deposit of hard scale was found on the inner rows of tubes in the fire-box. This was at first not easy to detect, and, in consequence, about half-a-dozen tubes on each side of the fire-box adjacent to the brick arch showed signs of overheating and had to be changed. The experience gained has resulted in the development of an apparatus by which the hardest scale can be readily cut out without damage to the tubes, and this will probably be necessary when the engine has run some 10,000 to 15,000 miles, according to the class of feed water used.

On the other hand, experience has also shown that this boiler can be worked for a much longer period than the ordinary type of locomotive boiler before requiring to be washed out. When stationed at Gateshead the locomotive worked express trains from York to Edinburgh and back, involving a daily run of about 420 miles. Whilst other engines of the "Pacific" type in the same "link" require washing out after running 1000 to 1500 miles, this engine ran 5000 miles without washing out, and when opened up it was found that the boiler was exceptionally clean and the tubes were in good condition. It was, however, found that the accumulation of mud and scale, which usually occurs above the foundation ring in an ordinary boiler, had fallen into the drums below the grate on each side of the fire-box. This material remained in the drums in the form of mud, from which it was easily removed, whereas, if it had been in the sides of an ordinary locomotive fire-box, much of it would have formed into scale.

Other means, which will be described later, have been recently embodied, by which the temperature of the water, when delivered in the feed water space in the top drum, is further increased before it passes to the evaporative portion of the boiler.

In a test which was carried out at the maker's works, an evaporation of 20,000 lb. per hour at 450 lb. per square inch was maintained for a period of 4 hours by the introduction of a steam jet up the chimney. This high rate of evaporation is possible owing to such a large proportion of the heating surface available being subject to direct radiant heat. In the ordinary form of locomotive boiler only the fire-box is subject to radiant heat, and the evaporation per square foot of heating surface of the tubes is only about one-fifth of that of the fire-box sides.

The superheater elements in this boiler are located in the forward portion of the central flue and are also subject to radiant heat. In order to prevent the flame impinging directly on the ends of the elements, a brick column is provided in the centre of the main flue immediately in front of the brick arch. Notwithstanding this precaution, and owing to the fact that there were no data available as to the effect of radiant heat on superheater elements, the temperature to which the steam was superheated during the preliminary trials was excessive, temperatures of 900 deg. Fah. being obtained; consequently, the lengths and area of the superheater elements have been reduced so that a temperature of approximately 700 deg. Fah. can now be obtained, and this is regarded as sufficient. The superheater elements are situated between the boiler and the regulator and are, therefore, always subject to full boiler pressure. In order to prevent overheating when the regulator is closed, the steam supplied for auxiliary services is taken from the superheater and passes through a coil of ribbed pipes laid in the feed-water chamber, thus raising further the temperature of the boiler feed and, at the same time, de-superheating the steam. This de-superheated steam is led to the reducing valve, where its pressure is reduced to 200 lb per square inch. Steam from this reducing valve supplies a manifold pipe on the footplate across the front of the boiler above the fire-hole door. From this manifold pipe steam at 200 lb. per square inch pressure is taken for supplying all the auxiliary services, such as the injector, vacuum for steam brake, reversing gear, steam-sanding, steam-heating, whistle and turbo-generator. It has been possible to retain the standard steam fittings for all these purposes. Fig. 11 shows the arrangement of these fittings.

With a pressure of even 450 lb. per square inch special designs of boiler fittings and valves have to be used owing to the cutting action of high-pressure steam, but in this engine only the safety valves, regulators and water gauges have had to be made suitable for this pressure.

After the hot gases have passed between the water tubes they enter the flues located at each side of the boiler. Naturally, the walls of these flues are very hot, and in order to reduce their temperature and to make effective

FIG. 10—THE YARROW-GRESLEY LOCOMOTIVE BOILER

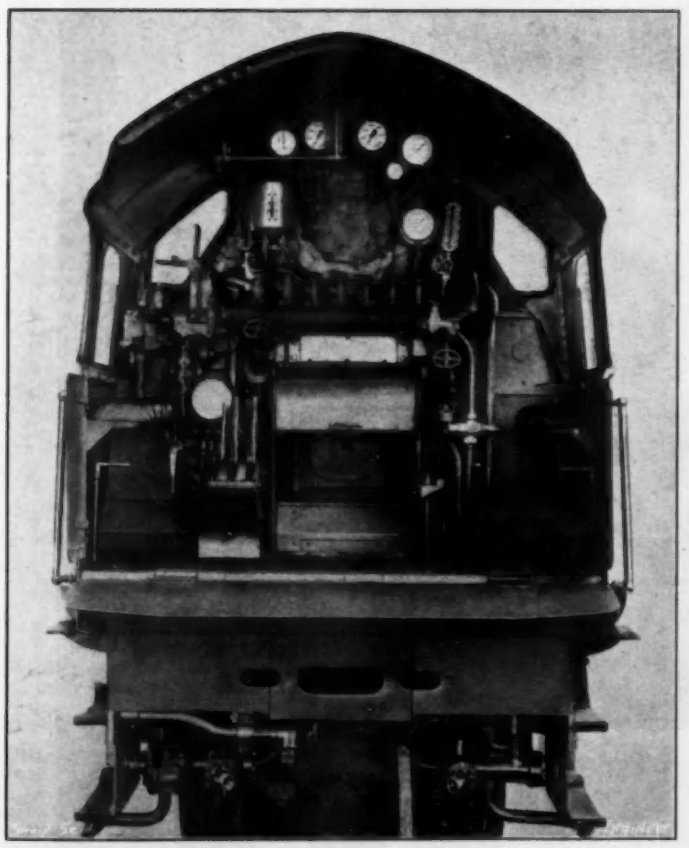


FIG. 11—INTERIOR OF CAB OF LOCOMOTIVE No. 10,000

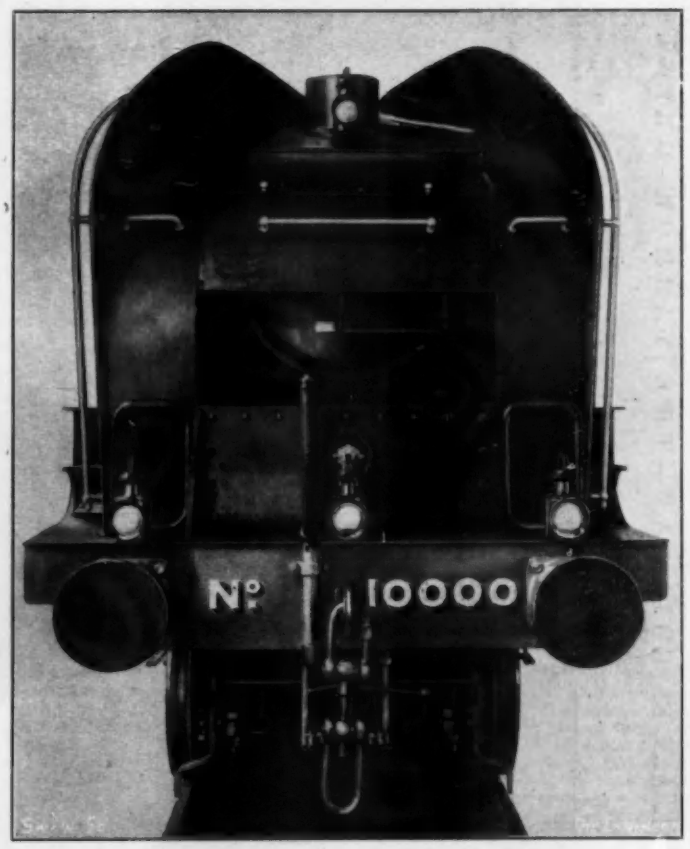
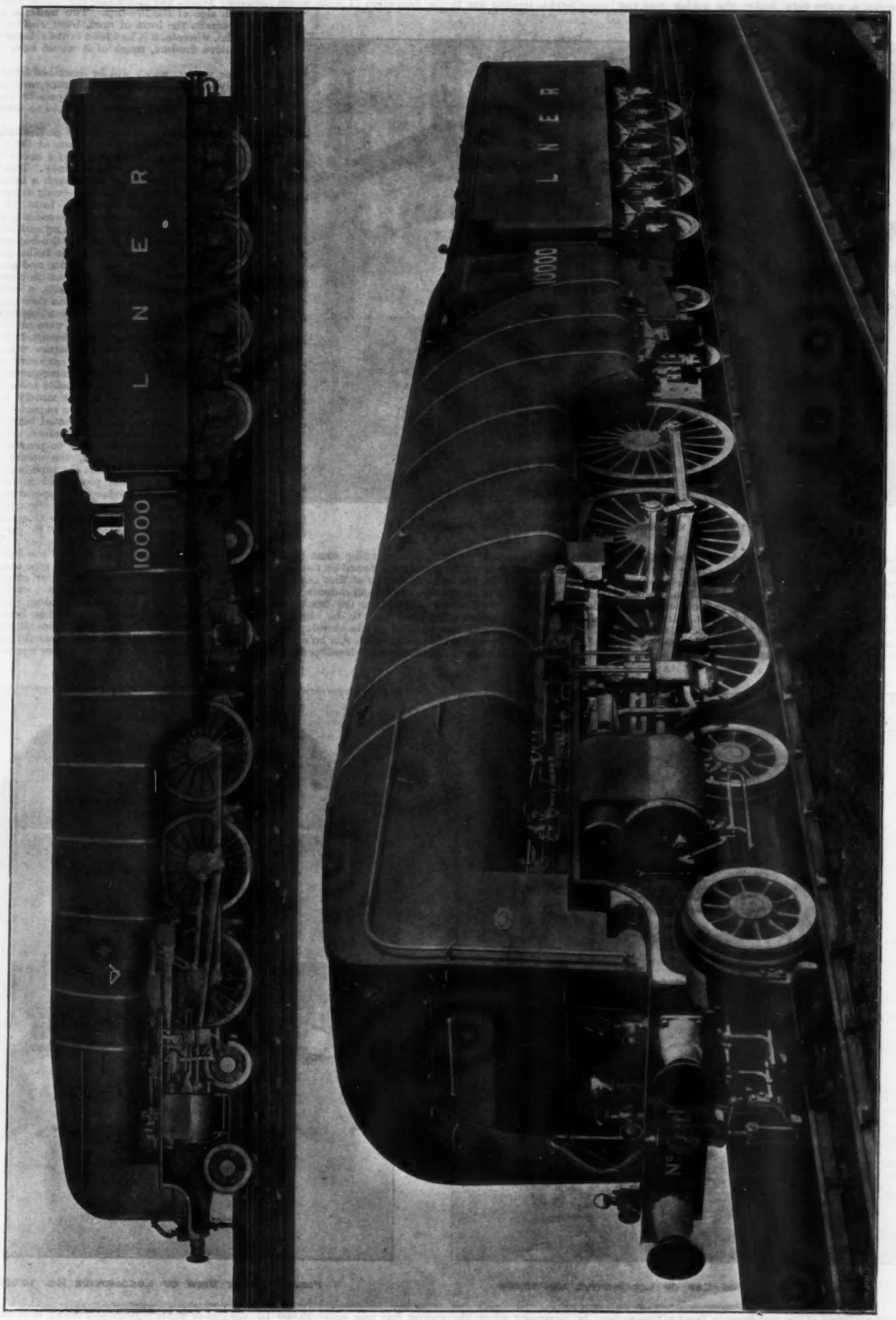


FIG. 12—FRONT VIEW OF LOCOMOTIVE No. 10,000



L. & N.E. RAILWAY—THE YARROW-GRESLEY HIGH-PRESSURE LOCOMOTIVE NO. 10,000

use of this heat, which otherwise would be wasted, the boiler was surrounded by an air space lying between the casing of the flues and the insulated outer clothing. All the air required for combustion traverses this air space from the intake at the front of the engine to the ashpan, and in so doing its temperature is raised to about 250 deg. Fah. It has been found that even when working hard it has not been necessary to supplement this supply of hot air by opening the ashpan door. Preheating the whole of the air supply is bound to augment the thermal efficiency of the boiler.

The only other feature of the boiler which calls for comment is the construction of the front end and chimney. Incidentally, the apparent absence of the chimney has caused more public comment than any other feature of the locomotive—side and front views are shown on page 166 and in Fig. 12. In order to provide sufficient length for the water-tubes, it was necessary to have the top steam drum as high as the limits imposed by the load gauge permit, consequently, there was no room for a chimney of the conventional type. Engines having large high-pitched boilers can only have very short chimneys, and trouble has been experienced in such engines owing to smoke and steam beating down on the front windows of the cab and interfering with the driver's view of signals. The author enlisted the assistance of Professor W. E. Dalby and constructed a wooden model of an engine of such a type. This model was placed in an air flume, and powdered chalk was blown up the chimney at the same time as a current of air was drawn through the flume at 50 miles per hour. Observations through a glass window showed the course pursued by the powdered chalk, and as a result of various modifications, the design finally adopted was arrived at. In this design the whole of the powdered chalk was lifted sufficiently to clear the cab windows, and it is satisfactory to record that in actual service the smoke and steam, whether running at slow or at high speeds, is deflected upwards sufficiently to clear the cab, and in no way obstructs the driver's vision.

As originally built, the engine had two high-pressure cylinders, 12in. in diameter, and two low-pressure cylinders, each 20in. in diameter, all cylinders having 26in. stroke. It has been found that by reducing the diameter of the high-pressure cylinders to 10in., a more equal distribution of work between the high-pressure and low-pressure cylinders results.

The author regarded it as necessary, whilst having only two sets of valve gear, to be able to vary the cut-off of the high-pressure cylinder independently of that of the low-pressure cylinder. He felt that only by trial at varying cut-offs could the best results be realised. He therefore arranged that in the rocking link by which the high-pressure valve is actuated, provision should be made by means of a slot and die-block to vary the travel of the valve at the same time retaining the combination lever to keep the lead constant. The motion arrangement for the high-pressure cylinders is shown in the Supplement, and for the low-pressure cylinders in Fig. 13. The reversal of the low-pressure valve gear, and consequently of the whole engine, is actuated by the ordinary form of steam-reverser, and a similar equipment is provided to vary the high-pressure cut-off. Both these equipments are attached to the shafts they actuate, and, being so remote from the footplate, their delicate control was not easy. This has been successfully effected by the use of telemotors; another telemotor is also provided for operating cylinder cocks. The high-pressure cylinders, steam-ports, passages and low-pressure steam receiver are formed by a single steel casting, as illustrated in Fig. 14, the cylinders and steam chests having special close-grained cast iron liners.

Various minor alterations and adjustments have had to be made since the engine was built, but with the exception of reducing the diameter of the high-pressure cylinders and reducing the heating surface of the superheater, it has not been necessary to alter any of its main features.

The locomotive has worked trains of over 500 tons weight for long distances at express speeds with consistent success and reliability, and although it has not been possible so far to carry out any extensive trials, there is every indication that it will prove more economical in fuel consumption than express engines of the latest normal types. Any economy effected in maintenance cost will only become fully apparent after the engine has run a few years.

It has been ascertained that the cost of a water-tube boiler similar to that fitted on this engine will not be appreciably greater than that of the ordinary wide fire-box type as fitted on "Pacific" engines. The most expensive components of the water-tube boiler are the solid-forged steam and water drums. These are not subjected to the action of the fire, and, consequently, may be expected to have a long life. On the wide fire-box type of ordinary boiler the copper fire-box is the most costly section, and it is well known that its life is short and its renewal is an expensive item. Again, in the ordinary type of locomotive, boiler tubes and fire-box stays are sources of trouble, involving costly maintenance and occasional failures. In the design of boiler under consideration, there are no stays; the tubes are more effectively secured, and are not subjected to variation in temperature and stress at the points where they enter the drums.

In conclusion, the author submits that, with the moderately high pressure and simple design which he has adopted, economy, both in fuel and maintenance costs, will be secured and, at the same time, the reliability so characteristic of British locomotives will be fully maintained.

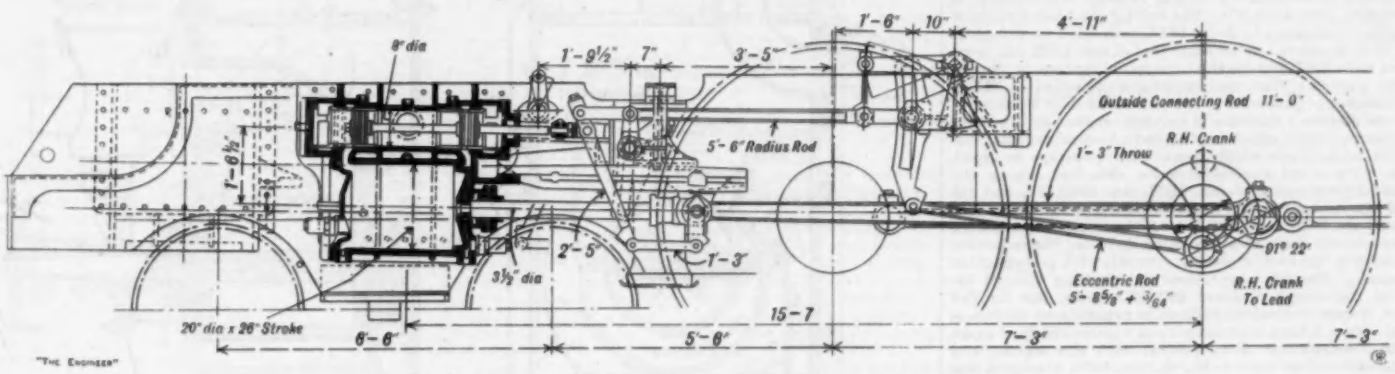


FIG. 13—MOTION ARRANGEMENT FOR LOW PRESSURE CYLINDERS

plant to Woodhall, Duckham and Co. Both these are British companies. It will be at least three years before the works are in full operation. It is then estimated that they will provide work for about 1700 white men. The total financial allocation of 5 millions—which is about twice as much as was originally contemplated—will be adequate to cover all emergencies and will also enable participation in subsidiary industries. As regards natural advantages, the undertaking should start with everything in its favour. South Africa has a practically inexhaustible wealth of first-class iron deposits, and it has an ample supply of good coking coal. The Pretoria works will actually be built on the top of iron ore deposits, which will not be worked, as the surrounding hills contain deposits of about 45 million tons of 48 per cent. pure iron. The Corporation also owns, about 100 miles away, deposits containing 100 million tons of hematite, averaging about 60 per cent. metallic iron. It is to be the policy of the board to confine the production of the corporation to what one might call the principal steel products, such as rails from 110 lb. per yard, down to the smallest types of steel bars to be rolled into sheets by another company, steel railway sleepers, building sections and girders up to 12in. depth, ordinary building merchants' requirements, and reinforcement bars and iron rods. The corporation will leave the manufacture of things usually done in foundries to the engineering works, of which South Africa has several excellent ones. It is anticipated that the corporation will have to import a staff of technical workers, such as the key men of various grades, but it is considered the local white labour resources are ample for ordinary requirements.

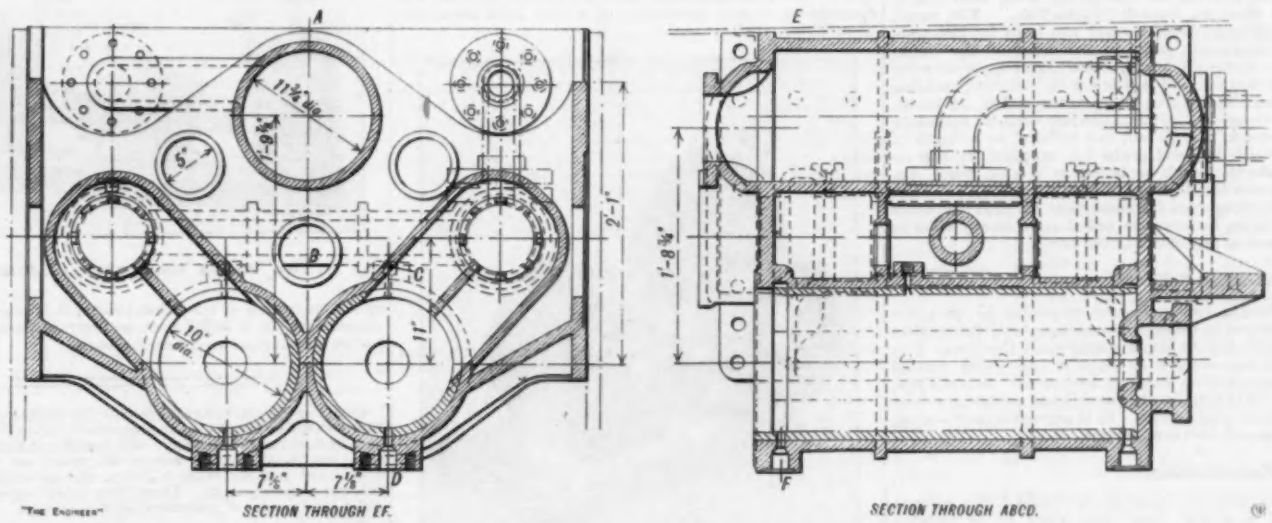


FIG. 14—CROSS AND LONGITUDINAL SECTIONS OF CYLINDER CASTING

South African Engineering Notes.

Pretoria Iron and Steel Works.

FULL details relating to the successful tenderers for the steel works to be built at Pretoria by the Iron and Steel Corporation are now made public. The chief contractor, as already advised, is Dorman, Long and Co., Ltd., so well and creditably known in South Africa, acting in co-operation with the German firm of Demag, for the smelting shop and rolling mill department. The contract for the blast-furnace plant has gone to Ashmore, Benson, Pease and Co., and for the coking and by-product plant to Woodhall, Duckham and Co. Both these are British companies. It will be at least three years before the works are in full operation. It is then estimated that they will provide work for about 1700 white men. The total financial allocation of 5 millions—which is about twice as much as was originally contemplated—will be adequate to cover all emergencies and will also enable participation in subsidiary industries. As regards natural advantages, the undertaking should start with everything in its favour. South Africa has a practically inexhaustible wealth of first-class iron deposits, and it has an ample supply of good coking coal. The Pretoria works will actually be built on the top of iron ore deposits, which will not be worked, as the surrounding hills contain deposits of about 45 million tons of 48 per cent. pure iron. The Corporation also owns, about 100 miles away, deposits containing 100 million tons of hematite, averaging about 60 per cent. metallic iron. It is to be the policy of the board to confine the production of the corporation to what one might call the principal steel products, such as rails from 110 lb. per yard, down to the smallest types of steel bars to be rolled into sheets by another company, steel railway sleepers, building sections and girders up to 12in. depth, ordinary building merchants' requirements, and reinforcement bars and iron rods. The corporation will leave the manufacture of things usually done in foundries to the engineering works, of which South Africa has several excellent ones. It is anticipated that the corporation will have to import a staff of technical workers, such as the key men of various grades, but it is considered the local white labour resources are ample for ordinary requirements.

The Zambesi Bridge.

Representatives of the Cleveland Bridge and Engineering Company, Ltd., of Darlington, the contractors for the building of the Zambesi Bridge connecting Nyasaland by railway with Beira, arrived in South Africa in December on their way to the scene of the building of the Zambesi Bridge, which is 2¼ miles long. The bridge is to connect the Trans-Zambesia Railway with the Central African Railway, thus putting Blantyre in direct communication with Beira. The weak link at present is the ferry, which crosses the river between Murraca and Chindio. During the dry season there is a difficulty and delay in getting the produce of Nyasaland down to the coast, and in the rainy season there are constant washaways along the railways. This bridge is intended to overcome the obstacles. The Trans-Zambesia Railway will be extended from its present terminus—Murraca, some 30 miles or more along the south bank of the Zambesi—to Sena, where the bridge is to be erected in several spans across the river to Mutarara. The bridge is estimated to cost £1,500,000, a great deal of which is British capital. It is expected to take four years to complete.

Johannesburg Extensions.

During the current Council year Johannesburg proposes dealing with numerous important schemes involving large capital outlay. The biggest is sewerage, for

which it is anticipated that a million sterling will have to be borrowed. A serious trial of trackless trolley omnibuses is to be made on the Norwood route at approximately a cost of £100,000. Further generating plant will be required in the Jeppe-street power station, and although a 10,000-kW extension, costing about £100,000, is mentioned, circumstances suggest the wisdom of putting in a much larger set next time, say, a 20,000-kW unit, for the demand is likely to grow at a rate sufficient to call for such a provision. No mention is made so far of the outlay contemplated in the distribution system, but another £100,000 could well be spent in that direction. There is a prospect of extensions in the water supply for the city being taken in hand, and an increase in capacity from 5 to 10 million gallons a day is favoured.

South African Railways.

The General Manager, in his report on the working of the Union of South Africa Railways for the financial year ended March 31st, 1929–1930, states that the loss on the Cape Town-Simon's Town railway line—which is electrified—was £239,870. The loss for the twelve months' electric working up to July, 1930, amounted to £230,881. The total revenue for the same period was £366,462, compared with £367,800 for the corresponding twelve months of the previous year, representing a reduction of £1338. The number of passenger journeys increased by 3 per cent., but the resultant increase in revenue on that account was to a large extent offset by the reduction of revenue due to the lower fares which came into operation in April, 1929. The total expenditure for this line during the financial year ended March, 1930, was £603,737, and the total expenditure during the later period of twelve months ended July, 1930, was £597,343. Although the expenditure figures do not show an appreciable decrease, the reduction obtained in the cost of electric current, with certain other economies effected, has reduced the working costs of the line to the extent of about £30,000 a year, but the full effect of these reductions will not be experienced until next year. The Administration's road motor services again showed remarkable development, says the report, and at the close of the year to March 31st, 1930, transport was being regularly conducted over 11,295 miles of road, an increase of 2010 miles on the previous year. The light capacity four-wheeled vehicles originally employed by the Administration in opening up its services, while serving a most useful purpose in conveyance of light traffic, have since been found totally inadequate, and are being superseded by heavier type six-wheeled units capable of carrying most classes of produce and merchandise.

Railcars.

Owing to the success of the experimental railcars built by the Union Railway's local workshops at Durban, for use chiefly in Natal, another twelve are being completed for the branch lines service. The vehicles are each driven by two independent six-cylinder petrol engines of 75 H.P., a propeller shaft drive being connected to the rear axle by two chains. Air brakes are fitted to the rear wheels. The overall length of the cars is 37ft. and the speed attainable varies from 20 miles an hour on a gradient of 1 in 30 to 50 miles an hour on the level.

Grab Dredger for Table Bay.

The harbour construction plant at Table Bay was added to recently on the arrival from Scotland of a new grab dredger, named "Springbok." The vessel is of 667 tons gross register, and was built by Ferguson Bros. (Port-Glasgow), Ltd., to the order of the Union Government. She is 176ft. long overall, has hopper capacity for 700 tons of spoil, and is fitted with twin reciprocating steam engines, which give her a sea speed of 10 knots. Three large cranes are fitted on the fore deck for operating the grabs, which, if required, can be used to a depth of 65ft. Specially-designed grabs are supplied for use on different materials, such as boulders, stones, sand, &c. An arrangement for drawing piles is also provided. The vessel will be employed for some time on dredging work in the new basin, but may be called upon at any time to do special work at any of the Union ports.

Benguela-Lobito Railway.

Shipping companies are preparing to meet the expected increase in traffic in connection with the opening of the Benguela-Lobito Bay Railway early this year. One Belgian line has decided to start a twelve-day service from Antwerp, calling only at Lisbon and Santa Cruz, while a leading Italian line has decided to initiate a service between Trieste and Lobito. It is expected that British shipping lines will also run services.

Sinoia-Kafue Railway.

The prospect of having the Sinoia-Kafue railway in existence in a few years' time seem to be growing brighter. The many advantages which this cut-off would give are already well known to those acquainted with Northern Rhodesia and its development. It will shorten the railway route from Northern Rhodesia to Beira by hundreds of miles, as the line across from Kafue to Sinoia would do away with the necessity for traffic going away down to Bulawayo and then back up north to Salisbury. The objection that the traffic over the route would not pay sufficiently to justify the cost of building of the line has now disappeared, in view of the great traffic which the opening of the huge copper mines in Northern Rhodesia would provide. The party which has been surveying the proposed route has now returned to Salisbury, having suspended work until the conclusion of the rains in April. The surveyors state that they consider that not only is the Sinoia-Kafue line feasible, having regard to the nature of the country it will have to pass through, but that it will be more easily constructed than were some of the lines in the Union of South Africa. Unfortunately, the route lies through some districts thickly infested by the tsetse fly, and although the country is splendidly suited for stock farming, this pest will prove a stumbling block to development. The region through which the line will have to pass is thickly inhabited by game of all descriptions.

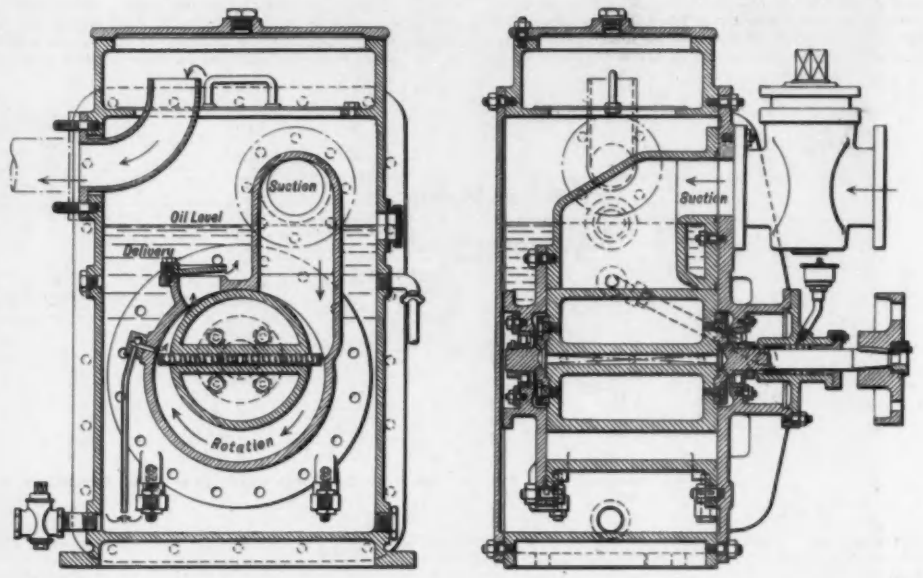
A Rotary Pump for High Vacua.

THE attainment of a high vacuum is necessary for a variety of industrial processes, and it has generally been assumed that this requirement involves elaborate and costly apparatus. The Pulsometer Engineering Company, Ltd., of Reading, has, however, produced a rotary pump, simple in the extreme, which will, we are informed, produce vacua within one-fiftieth of a millimetre of mercury of a perfect vacuum, in one stage of pumping. Below we give a sectional view of one of these pumps, together with two engravings showing its application.

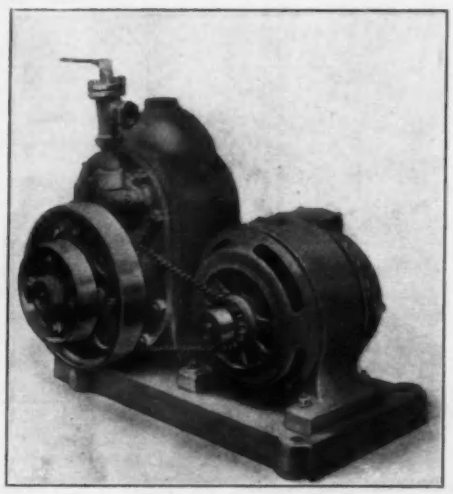
The Fleuss system of vacuum pumping, with the assistance of an oil seal, is generally known to engineers, but it is associated with the principle of reciprocating pumps. The new pump is, however, of the rotary type and, consequently, can be run at much higher speeds, with a consequent increase in capacity.

The general design of the pump is of the familiar type of rotary machine—that is to say, it has a rotor, set excentrically in a casing and provided with two blades, or pistons, as shown in the sectional drawing.

There is one slight peculiarity in the arrangement, in that the bore of the casing is not truly circular and has a short arc of the same radius as that of the rotor between the inlet and outlet ports, so as to extend the usual line contact between the two parts to that of several inches width. This arrangement naturally tends towards the elimination of any possibility of a leak back from one port to the other. The seal is, however, assured by a film of oil supplied by the casing which surrounds the pump proper.



SECTIONS THROUGH HIGH-VACUUM ROTARY PUMP



MOTOR-DRIVEN SINGLE-STAGE PUMP

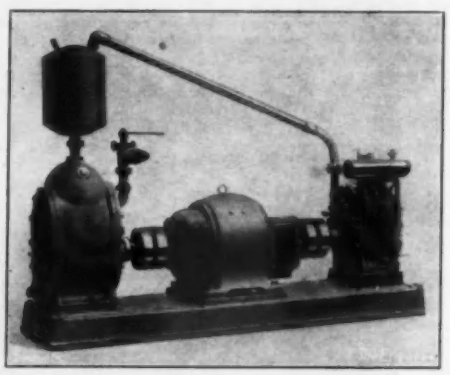
As will be seen from the drawing, the whole of the working parts of the machine are submerged in a bath of oil, the suction branch is above the level of the oil and the delivery valve is below. The consequence is that the valve is completely sealed against the return of air from the atmosphere, provided that the depth of oil over the valve is sufficient. The delivery valve is of the simple spring plate type, and its construction may be readily followed in the drawing.

The vanes, or pistons, of the rotor are urged outwards against the casing by means of internal springs, so as to keep tight contact regardless of centrifugal effects; but the assurance of an air-tight joint is effected by the constant introduction of a small portion of oil. This oil is sucked up through the pipe shown in the drawing, and is discharged back again into the reservoir, together with the outgoing air. Any atomised oil, which may be carried in suspension by the discharge, is separated out by a system of baffles and screens, so that practically none of the oil is lost.

It is noteworthy, in connection with this scheme of sealing, that it has been found necessary to make the edges of the working vanes sharp and square, and not, as might be thought, to conform, more or less, to the shape of the casing. The presumption is that with a sharp edge the film of oil is scraped forward at each revolution, while with a rounded edge the film of oil would be slipped over and tend to accumulate. It is also noteworthy that even after extended service the edges of the vanes remain quite keen.

The constructional details of the machine are fairly obvious in the drawing, but it should be pointed out that the rotor is carried in a set of roller bearings distinct from those of its driving shaft, so that its alignment with its casing cannot be disturbed by the pull of the drive, whether it be by a directly connected motor, or by a belt.

These vacuum pumps are made in several sizes, ranging in displacement capacity from 2 cubic feet to 110 cubic feet per minute, and when two are connected in series, as shown in one of our illustrations, it is claimed that a vacuum within 0·00007 mm. mercury of perfect vacuum can be obtained on a commercial basis.



TWO PUMPS CONNECTED IN SERIES

CORPS OF NAVAL CONSTRUCTORS.—The annual dinner of the Royal Corps of Naval Constructors was held on January 30th, at Park-lane Hotel, Piccadilly. The Director of Naval Construction, Mr. A. W. Johns, was in the chair, and Sir Eustace d'Eyncourt and Sir William Berry, two previous holders of this post, were present. There were many important guests and a good muster of past members of the Corps.

ROYAL INSTITUTION.—At a general meeting of the members of the Royal Institution, held on Monday afternoon, February 2nd, Lord Eustace Percy, President, in the chair, the thanks of the members were returned to the Trustees of the Pilgrim Trust for their donation of £16,000 to complete the Building Fund, and to Sir Robert Hadfield for his present of research apparatus. A bequest of £100 from the late Mr. W. H. Frizell, M.R.I., was reported. Miss Grace Freeth, H.H. the Maharaj-Rana of Jhalawar and Dr. J. M. Robertson were elected members.

MINERAL RESOURCES OF THE EMPIRE.—In continuation of the series of special exhibitions designed to draw attention to the Empire's resources of raw materials, which have been held at the Imperial Institute, a special exhibition illustrating the mineral resources of the Empire has been arranged. It will be opened by Mr. Amery on February 17th, next. The exhibition, although primarily intended to bring home to the general public the vast stores and great variety of minerals available within the Empire, will also supply information to the student of economics and even be of interest in some instances to the technical expert. It will be arranged on a geographical bases and, besides the numerous mineral specimens, there will be exhibited many enlarged photographs, diagrams, maps, flow-sheets, &c., illustrating the mineral industries of the various countries represented. As a result of the active co-operation of the overseas Governments concerned, mineral specimens numbering upwards of two thousand have been specially sent to supplement those already available at the Imperial Institute. Many of the samples are from newly developed mining areas and from those awaiting development.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Prevailing Conditions.

THE general position in the iron and steel producing and consuming industries of the Midlands and Staffordshire shows no sign of advancement. The past week has not brought any expansion of demand for iron and steel materials or of activity at the works and factories, and in the main the industries of this area continue depressed. There has been little interest displayed on 'Change in Birmingham this week, and the market tone at to-day's weekly gathering can only be described as "spiritless." The business transacted was infinitesimal.

Pig Iron Prices.

Consumers of pig iron have been unsuccessful in their claim for a further reduction in Midland iron prices, and to say that they are disappointed is to put it mildly. They claim that values are upheld on an uneconomic basis by the Central Pig Iron Producers' Association, and they are loud in their denunciation of its action. Smelters were evidently much influenced by the fact that the previous reduction in pig iron failed to stimulate demand, and they had no evidence before them that any more success would be met with in the event of their granting further concessions just now. In another month's time, when they will be meeting in conference again, the position may be more satisfactory, and they may feel justified in reducing prices. Again, stocks at furnaces may have become so unwieldy as to force their hands, to the advantage of the buyer. Meanwhile, selling prices will remain at January's level, consumers having to be content with the rebate announced in December. Quotations on 'Change in Birmingham to day were :—Northamptonshire : Forge, £3 2s. 6d.; No. 1 foundry, £3 10s. 6d.; No. 2, £3 19s. 6d.; No. 3, £3 7s. 6d.; No. 4, £3 6s. 6d. Derbyshire : Forge, £3 6s.; No. 1 foundry, £3 14s.; No. 2, £3 13s.; No. 3, £3 11s.; No. 4, £3 10s.—delivered at stations in the Black Country and subject to rebate. Transactions were few and restricted, alike in the foundry and forge departments.

Staffordshire Bar Iron.

The Staffordshire wrought iron industry is irregularly employed, and ironmasters consider the situation most unsatisfactory. Many of the Black Country consuming industries are at date under the cloud of depression, and with works engaged only three days a week raw material requirements are almost halved. Not only so, but trades, such as nut and bolt manufacture, which formerly used iron, have of late years increasingly gone over to steel, on account of its being so much cheaper. Even then many of the works employ foreign material in an endeavour to capture orders by quoting low figures for the finished goods. The amount of continental raw material which has come into this district of late, however, has been much below what it was six months ago. The chief reason for this is that activity at the works has steadily declined, until to-day some of the largest and best-known firms experience considerable difficulty in providing their employees with even half a normal week's work. In the best bar department there is a more or less regular demand for marked bars for exacting engineering requirements, and in this department some of the mills are working steadily. There is no large reserve of orders, however, and ironmasters cannot see more than a week or two ahead. Crown or merchant quality bars are in poor request, and offers of supplies at "cut" rates have not been taken up. Tube strip mills are doing a little better, sales being more regular, but not notably increased in bulk. Values of marked bars are maintained at £12 10s. at makers' works, but other grades are gradually deteriorating. Crown bars which when the month opened were at a minimum of £10, are now to be obtained at £9 15s., while nut and bolt and fencing bars which were £9 are now only worth £8 15s. Wrought iron gas tube strip sells at £0 17s. 6d. per ton delivered.

Steel.

The steel trade is making little, if any, headway. There are occasional flickers of improvement in certain minor directions, but the industry on the whole remains depressed. District steel works are all complaining of the small specifications which come in, necessitating the frequent changing of the rolls. Some structural engineers are keeping their yards occupied, but the steel required has been bought previously, and new contracts are scarce. Engineering firms are examining every possible opening for new business. Development in the home market has been slow, but constructional engineers with overseas contracts have been more active. Most of the steel-consuming heavy engineering industries are going through a slack period, and consumptive demand is at a low ebb. Many users complain that the level of prices stands too high, and are pressing for reductions. In regard to materials, prices of which are not controlled by the Makers' Association, the pressure has been effective, and values have gradually but markedly declined. Little heed to the consumers' agitation has, however, been paid by the body of steel masters controlling selling prices of finished steel, and it is in this department that unrest is most manifest. Present prices, consumers assert, are holding up many enterprises. In the half-products branch, foreign competition has had much to do with the subsidence of selling rates. Consumptive demand is small, and it is doubtful whether with production at its present level to-day's selling prices are remunerative. They certainly do not leave a large margin of profit. What is wanted, alike in the finished and semi-finished branches of the steel trade, is increased turnover. Midland importing merchants experience difficulty in persuading users to buy foreign steel, although attractive prices are being offered for prompt sales. Under existing industrial conditions, when works are consuming only small quantities, it is convenient to buy sparingly. Steel masters in this area are in a position to give very prompt delivery, whereas delays in transit are often associated with continental material. These circumstances weigh against the foreigner, and native steel at the higher price is now often bought on account of its being immediately required.

Galvanised Sheets.

Business remains quiet at the sheet mills in this district, and owing to lack of orders full production is not possible. Export orders are few and of comparatively small proportions, and there is no evidence of the probability of an early expansion of demand in response to the recent lowering of selling rates. It is interesting, as showing the deterioration of values in this branch of the market, that the present quotation of £11 per ton for 24 gauge corrugated sheets is lower than any which has existed since pre-war days. The market is missing the Indian business. Shipments to that market last year were very much below those of the previous year, and now that an import duty has been imposed against us, the difficulty of selling to India is increased. It is reported that some manufacturers consider the difficulties in this market insurmountable. Home demand for sheets keeps up fairly well, but its volume, comparatively speaking, is but small. Black sheets are being called for with increasing regularity by automobile engineers. Values remain substantially unchanged.

Staffordshire Coal Dispute.

The report of the National Board for the Coal Industry on the dispute in the North Staffordshire coalfield recommends that the owners and workers should come to an agreement for working upon the following basis :—Monday, Tuesday, Wednesday, Thursday, and Friday, the shift for underground workers to be 7 hours 48 min.; on Saturday, 6 hours. The hours of surface workers to be adjusted accordingly. The rates of wages, subsistence wages, customs and conditions of work in operation in November, 1930, to continue. The terms to continue to March 31st, 1931, and thereafter until altered by agreement between the parties. Mr. J. A. Hall, a member of the Board, in a separate report, states that he does not concur with the majority report on hours and wages, and recommends that working hours should be 7½ a day, including Saturday, with a proportionate increase of wages for pieceworkers.

Rolling Stock Prospects.

The recent report of Mr. M. F. Maclean, chairman of the directors of the Gloucester Railway Carriage and Wagon Company, Ltd., regarding the general trading position of the company, contains some unpleasant reading for those connected with the rolling stock industry in this area, for it points rather towards gloomy than towards cheery prospects. "The prospects for the remainder of the year," he reports, "are anything but encouraging, and when I tell you that, at the time of writing, there is only one single inquiry on the market for passenger rolling stock from any part of the world, you will realise how universal is the blight on trade."

Unemployment.

The unsatisfactory condition of trade in Midland industries is shown by the fact that unemployment is higher by 163,000 than it was at this time last year. The latest returns record the number of wholly unemployed as 225,071, temporarily stopped 130,285, and normally in casual employed 549, making a total of 355,905. This is an advance of 3217 on the previous week. The number of workless in the Birmingham area is 60,441 ; Stoke-on-Trent, 35,121 ; Nottingham, 15,717 ; Leicester, 15,601 ; Wolverhampton, 12,744 ; Derby, 11,487 ; Walsall, 10,617. With the exceptions of Bilston, Dudley, and Oldbury, all the Black Country areas are in a worse position than they were a week ago. Of the grand total of unemployed, no fewer than 236,742 are male adults.

Mr. J. E. Perry's Death.

Mr. John Edwin Perry, whose death, after three weeks' illness, took place at Mayfield House, Wolverhampton, on Sunday last, was well known in the local iron and steel trades. Mr. Perry, who was in his ninetieth year, founded the business of John E. Perry and Son, Ltd., metal merchants, Wolverhampton. He had been a prominent figure, both on London and Birmingham metal exchanges.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Demand for Municipal Economy.

The nightmare of a substantial addition to overhead charges faces the engineering and allied industries of the Manchester area through a threatened addition of 11d. to rates which already inflict a heavy burden on production costs. The Engineering and Metals Section of the Manchester Chamber of Commerce has always kept a keen eye on civic expenditure, and a year or two ago the case of the heavy industries was the subject of direct representation by the Section to the municipal authorities. On that occasion a striking comparison of the rates and taxes burden of local engineering concerns with that of continental competitors, was put forward, and a strong plea made for drastic economies in expenditure. Of any direct results of those representations, however, there has been little sign. This week, on behalf of the engineering and other industries represented by the Chamber of Commerce, the President, Mr. Herbert W. Lee, has renewed the campaign, stressing, in a letter to the Lord Mayor, the fact that business concerns in the city are faced with greatly reduced turnover and earnings, owing to the fall in prices and the stagnant trade position, and that the prospect of having to pay heavier rates, thus adding to their overhead costs, causes them great alarm, especially as they all realise that trade recovery can only be brought about by a reduction of costs in every section of trade.

Electricity Board to be Dissolved.

Set up under the 1919 Act to supervise the electrical development of the South-East Lancashire district, in co-operation with the Electricity Commissioners, the South-East Lancashire Electricity Advisory Board has decided to dissolve voluntarily, and the Electricity Commissioners have been requested to take the necessary steps to secure a dissolution order. A formal inquiry with this end in view was held in Manchester on Friday of this week—February 6th.

Direct to Alternating Current.

Salford Corporation Electricity Committee has decided to accept the financial terms of the offer of the Unemployment Grants Committee relating to the work of changing over from D.C. to A.C. during the next two years. The original proposal of the Electricity Committee was to carry out a somewhat smaller programme over a period of five years.

Bridge and Road Scheme.

The Unemployment Grants Committee has accepted a scheme submitted by the municipal authorities of Heywood, near Manchester, for bridge and road construction estimated to cost just short of £40,000, of which £24,000 is involved in the construction of a bridge. Work is to be commenced by the middle of March, and completed within two years.

Obituary.

The death occurred last Sunday of Mr. Robert C. Livesey, managing director of Henry Livesey, Ltd., loom makers and textile machinists, of Greenbank Ironworks, Blackburn. Mr. Livesey, who was 73 years of age, was a former chairman of the Blackburn and District Engineering and Allied Employers' Association, and was also chairman of the board of directors of Hutchinson, Hollingworth and Co., Ltd., loom makers, Dobeross.

Non-ferrous Metals.

Lacking the necessary incentive to a steady market, the non-ferrous metals, this time including tin, have experienced another black week, losses being general. During the past month or so, the knowledge that negotiations were proceeding for a further tightening up of output restriction has helped to sustain the tin market, but more recently the failure to reach an early agreement seems to have exhausted the original "bullish" influence, and the present tendency of the market appears to be towards a gradual drift-back to the £100 mark, to which tin prices were dangerously near as recently as mid-December. The lack of buying activity is, of course, a primary depressing factor. With regard to copper, both here and in the other big consuming markets in Europe and America, early requirements of standard, as well as of refined, descriptions of the metal, appear to have been adequately met, and inquiry during the past week has been slow. The result has been, for the second week in succession, a fall of nearly 20s. a ton. Spelter continues to create history from the point of view of low price levels, and with demand still appreciably below current production, values have steadily drooped. This has also been the experience in the case of lead, and, as they have done each week since the beginning of the present year, prices have lost ground to the extent of about 10s. a ton, bringing the rates current at the moment of writing lower than they have been at any time during the past twenty years.

Iron and Steel.

With operations at the works of Lancashire textile machinery manufacturers almost generally curtailed, and with unsatisfactory conditions in evidence at most of the general iron foundries, it is not surprising that no expansion in the movement of pig iron into consumption can be reported. The only relatively bright spots are a few foundries making specialities, but their demands represent only a small proportion of the normal total consumption of iron. There has certainly been no rush to buy forward during the past week, and month-to-month commitments are about the extent of current transactions. Prices, however, are much the same as they were in my last report, with Derbyshire and Staffordshire foundry at 69s. 6d., Northamptonshire at 68s., Cleveland at about 71s., Scottish at from 90s. to 91s., and West Coast hematite iron at about 84s. 6d. per ton, all delivered equal to Manchester. Bar iron makers report a very disappointing trade, with Lancashire Crown quality bars still quoted at £10 5s. per ton, and No. 2 material at about £8 15s. There is nothing resembling a general buying movement in the case of steel, either home or foreign made, actual orders being spasmodic and, for the most part, relating to small or medium sized parcels for near delivery. Sections are at £8 7s. 6d. per ton, joists at £8 15s., large diameter bars at £9 7s. 6d., general plates at £8 17s. 6d., boiler plates at about £9 5s., and small re-rolled bars at £7 2s. 6d. A certain amount of buying has been done in continental "semis," values of which, as well as most of the finished products, have weakened still further during the past week.

A New High-speed Yarn Winding Machine.

With the objects of simplifying the construction of yarn winding machinery and giving higher speeds of operation, the Universal Winding Company, Saville-street, Manchester is now placing on the market a new machine with a novel traverse mechanism, which overcomes the disadvantages of earlier machines by the elimination of cams and reciprocating parts. These results are accomplished by guiding the yarn on to the package by means of grooves formed in the surface of a cylindrical roll. These grooves are formed like opposite crossing helixes, which extend over the whole length of the roll which is in contact with the yarn package, so that the yarn draws at a tangent

to the traversing roll and occupies only a small portion of the guiding groove. The makers claim that by this arrangement, there is no perceptible friction or strain imposed upon the yarn. The important feature of this method of operation lies in the construction and arrangement of the grooves at the points of crossing to ensure that the yarn will be guided from one end of the package to the other and back again without being diverted from its direction of feed or travel. This is accomplished by forming the grooves so that the bottom of one is at a different level from that of the other where the grooves cross each other, and by chamfering the projecting point which separates the grooves. I am informed that winding speeds as high as 800 to 1000 yards per minute are possible with this new form of construction. Another improved feature embodied in this machine is the stop motion in which the breakage lever pivots in combination with a stopping lever, so that when a breakage of yarn occurs, the first-named lever moves back and allows the stopping lever to move into the path of a cam and lift the package from the drum.

BARROW-IN-FURNESS.

Hematite.

Business in hematite pig iron is generally quiet and the total trade can easily be handled with the existing production, which is far from the normal, and, in addition, there are large stocks of iron to draw upon should occasion arise. The local consumption of iron is maintained mostly by steel makers at Barrow and Workington. Not much is being done on continental account and at present American trade is in the background. There are two furnaces blowing at Barrow, two at Millom, one at Ulverston and three in West Cumberland. At Backbarrow a special refined iron is being made. Iron ore is in fair demand.

Steel.

The renewed activity in the steel trade is well maintained, industrially and a good output of rails is being noted at Barrow and Workington. These rails are for both home and overseas buyers. Hoops are being rolled at Barrow, largely for overseas.

Fuel.

For fuel there is a steady, if not brisk, demand, both for coal and coke.

SHEFFIELD.

(From our own Correspondent.)

Heavy Steel Rather Better.

WHILE there is no evidence of a revival in the buying of open-hearth steel, some slight improvement in output is to be noticed. The United Steel Companies have found it necessary to increase production, in order to clear off some arrears of work, and they have now in operation, at the Templeborough works, eight basic furnaces and one acid, and, at the Ickles, one acid furnace. Increasing production is also reported from other works, making open-hearth steel. There is, however, a great scarcity of forward business in such material, although small orders are numerous. The recent reductions in the prices of iron and steel material have not stimulated trade so far. Values of scrap remain low, as normal buying has not yet been resumed since the opening of the New Year, but a better tone is indicated by the latest reports.

Heavy Manufacturing.

On the heavy manufacturing side, conditions continue unsatisfactory. Orders are occasionally received for castings and forgings of great bulk and weight, and of a special character, but in spite of these the large steel works have a good deal of plant that is wholly or partially idle. An exceptionally large casting has been made by the Brightside Foundry and Engineering Company for the English Steel Corporation. It weighs 112½ tons, and is an octagonal cast iron ingot mould for making ingots and forgings, both hollow and solid. It is stated to be the largest casting ever transported in Sheffield. In order to convey it the half-mile between the two works last week, five traction engines were used, and the journey was accomplished in about a quarter of an hour. It was slung on to the platform of the transport vehicle by means of an electric crane with a lifting capacity of 150 tons. There is less and less being done in the departments devoted to the production of railway axles, tires, and springs. The drastic economies which the home railway companies are carrying out will entail further reductions in their purchases of steel and rolling stock, while export business continues at a low level. Very little material is called for in respect of wagons for private owners, the building of which is on a very small scale. Some improvement in these departments will result from the orders placed in connection with the Boxer Indemnity allocation, the first batch of which is expected in about two months. There is a great scarcity of work at the rod rolling mills, but the demand for sheets is reviving.

Special Departments.

There is a brighter story to tell of stainless, heat-resisting, and corrosion-resisting steels. Sales are not only maintained at a good level, but continue to increase, and the outlook is considered very promising. An extension of the manufacture of stainless steel articles is being carried out by the Croft Cutlery Forging Company, Ltd., of John-street, Sheffield, which is taking over the Victoria Tool and Fittings Company, at Darnall, and intends to make there domestic and motor car fittings, domestic utensils, domestic furniture, table ware, hospital equipment, sanitary, railway, shop fittings, and other articles from stainless steel, by mass production methods. The number of operatives at present employed is seventy, and it is anticipated that when the arrangements are completed this number will be increased to 300. There is not a great deal of work on hand in the best grades of tool steel and the various alloy steels, but some firms are moderately well employed. British users are ordering sparingly, and the exports to several markets have been curtailed as a result of the world depression. Alloy steels are selling fairly freely to the builders of heavy automobiles, who also purchase a good deal of tool steel and tools, but the call for supplies for pleasure cars, motor cycles, and bicycles, is poor. There is no sign of improvement in the crucible steel department, which is very flat. Taking local trade as a whole, January was a poor month. The volume of work on hand was not only less than that of the previous January, but also showed a fall in comparison with December, up to the holiday stoppage. Rather more numerous inquiries were reported towards the end of the month, but they were not sufficient to promise increased activity in February. It is, however, thought that some branches show a little improvement, and among business principles a fair amount of confidence is to be met with.

More Rationalisation.

Details are now available of the latest Sheffield rationalisation scheme—the merging of the heavy steel interests of the two famous firms of John Brown and Co., Ltd., and Thos. Firth and Sons, Ltd. The firms are next-door neighbours at Brightside, and are already closely allied, as Browns hold a majority of the ordinary shares in Firths. It is proposed to sell and transfer to Firths that section of Browns' business which consists of the Atlas Works, Sheffield, and the Scunthorpe works, together with stock-in-trade, tools, stores, work in progress, &c. The object is to effect economies in the heavy forgings and castings trade, and it is not intended that the rationalisation shall be confined to the two firms now concerned. Lord Aberconway, the chairman of John Brown and Co., in a circular which he has addressed to the debenture holders, states that "as soon as the amalgamation is made effective, the way will be clear for consideration of the possibility of widening the basis of rationalisation of the heavy steel industry by bringing other businesses under one control, and thereby further augmenting efficiency in manufacture and marketing of products, and eliminating the cost of maintenance of redundant plants." A director of John Brown and Co. says that the hope is that employment will be increased by the merger; at any rate, no men will be thrown out of work. He adds that the names of the firms will probably be changed to "Thomas Firth and John Brown, Ltd."

Trade Mission to Egypt.

Sheffield is taking a conspicuous part in the campaign for extending the country's trade abroad by means of special missions. Following hard upon the return from South America of the mission on behalf of the lighter trades of the city, headed by Mr. A. K. Wilson—ex-Master Cutler—the United Kingdom Trade Mission to Egypt has left this country, under the leadership of Sir Arthur Balfour. In an interview shortly before sailing, Sir Arthur expressed confidence, based on the study of Egyptian trade which the Mission has already made, that tremendous developments will take place in the future, so far as this country is concerned. "After we have done our work," he said, "it will be for the trades themselves to follow it up with personal visits to the market to study what kind of goods are wanted. Meanwhile, the manufacturer can be doing something to get down his costs of production, a matter of the utmost necessity, since the countries competing with us have a considerable advantage in costs on account of their lower taxation and other causes."

Cutlery and Plate.

Very large quantities of goods coming under the heading of cutlery and plate are still being produced for coupon and bazaar distribution, but the ordinary home trade is slack, as the public are making smaller purchases than formerly. There is a falling off in most of the overseas markets, especially Australia, the comparative collapse of which is a serious matter for the trades. An American importer of safety razor blades has sent an inquiry to this country for quotations for supplies of blades in quantities of 5, 15, and 25 millions. There has been a further fall in the prices of cutlery, spoons and forks, which in some cases are now cheaper than before the war. The Sheffield Advisory Committee, an official body which does valuable work in protecting the trade name of the city, expresses regret, in its annual report, at the abolition of the safeguarding duty on cutlery, "which," it says, "has never caused cutlery to be more expensive." The Government is asking for tenders for the supply to the Army of 3000 salt cellars made from stainless steel. The steel is to be either Firth's, Brown Bayleys', or Hadfield's, and as a guarantee of quality the brand is to be marked upon the bottom of the articles. Tenders are invited by the Royal Army Clothing Department for 101,500 spoons and 97,000 forks—unplated—and 110,500 table knives; and, by other Government Departments, for 1000 ivory table knives, 6000 table knives with electro-plated handles, 52,000 knives with nickel-plated handles, and 3000 carving knives and steels.

NORTH OF ENGLAND.

(From our own Correspondent.)

Steel Exports Slump.

THE slump in the steel trade, and the difficulties confronting exporters owing to the restrictions upon trade with India and Australia, are reflected in the records of iron and steel shipments from the Cleveland district for January. Not since the period of the coal strike in 1926 has the aggregate volume of shipments of manufactured iron and steel fallen so low, the January total being only 31,634 tons, compared with 37,021 tons in December, and a monthly average for 1930 of 46,500 tons. Not a ton of steel was shipped to Australia, and only 2048 tons to India. Africa continues to be a good customer, and last month took 6247 tons, while 2241 tons were sent to the Argentine. The pig iron exports show signs of expansion. The month's total of 14,222 tons compares with only 8803 tons in December and 12,301 tons in November. Coastwise shipments advanced from 2945 tons to 7685 tons, Scotland's quota advancing from 2610 tons to 4231 tons. The overseas exports reached 6537 tons, compared with 5858 tons, the best buyers being Italy with 2830 tons and Denmark with 1300 tons.

Cleveland Iron Trade.

When the general industrial depression is taken into consideration, the volume of business in Cleveland pig iron is by no means disappointing. Fresh purchases of foreign iron for delivery on the Tees have ceased, and more orders are coming to hand from home consumers. Nearly all these orders are for early delivery, and there is still a little inclination to negotiate period contracts. In Scotland, industrial requirements are very limited, but Cleveland makers are getting a bigger share of the business, and, coupled with increased requirements from the steel furnaces, this fact is having the effect of reducing stocks. Further expansion, however, will be necessary before there is any talk of increasing output. The fixed minima to all areas except Scotland are: No. 1 Cleveland foundry, 61s.; No. 3 G.M.B., 58s. 6d.; No. 4 foundry, 57s. 6d., and No. 4 forge, 57s.

Iron Trade Wages.

As a result of a fall in the average realised selling prices during the last two months of 1930, there has been a sliding scale reduction of 2½ per cent. in puddling and other forge and mill wages paid by the North of England Manufactured Iron Trade Board. This reduction took effect from Monday last.

Hematite Pig Iron.

Sellers of East Coast hematite pig iron continue to realise high prices compared with rates ruling for Cleveland qualities. Occasional export sales are reported, but most of the business passing is for home use. Stocks are gradually falling, but are still heavy. Merchants have a good deal of iron on hand, but are slow to make price concessions. Ordinary qualities of hematite vary from 69s. to 70s., and some makers are not keen to sell at the latter figure. No. 1 quality is at a premium of 6d. per ton.

Ironmaking Materials.

Sales of foreign ore are extremely few and small. Nominally best Rubio is 16s. c.i.f. Tees, but odd lots have been purchased at less. Consumers of blast-furnace coke are also buying very sparingly, and are unwilling to pay prices asked. Producers still quote 17s. for good average qualities delivered to North-East Coast works.

Manufactured Iron and Steel.

Manufactured iron and steel quotations are unaltered. Certain descriptions of finished steel are in rather better request, but orders for all kinds are much needed. In departments producing railway requisites and constructional steel, however, the tonnage output is considerable, and another steel furnace has been put into operation by Dorman, Long and Co., at Middlesbrough

The Coal Trade.

The forward prospects in the Northern coal trade are still very uncertain. Exporters state that they are receiving very few inquiries. Prompt trade is fair, and most of the best steam and gas coal collieries are well stemmed for the next week or two. Second grade fuel, however, is meeting with slow support, and idle time at a good many pits appears imminent. There is no immediate likelihood of the minimum prices being revised; hence, a severe testing time is at hand for the marketing schemes. They certainly put a check on collieries undercutting one another, but merchants are refraining from buying from the producers on a speculative basis and so assuring them of trade. On the other hand, collieries are freer from the contingency of merchants not taking out their quantities when the market is against them. It is not easy to sell coal for export at the present fixed prices, but it might be very disadvantageous to alter them at present, as such action would be likely to have an unsettling effect upon foreign consumers and cause them to wait and see if any further revisions were coming. The general trend of the Northumberland steam coal trade is easier and demand is steadily falling off, and although most of the collieries are able to report a favourable outlook for this month, many are faced with an anxious time to clear their output under the present quota allowance. Contractors are, consequently, hard pressed to clear the balance of their holdings. Best Northumberland steams are offered at 13s. 6d., with seconds at 12s. Durham gas coal qualities are well booked up, and for any surplus are quoted firmly at 15s. to 16s., but secondary gas coals are plentiful, and in the absence of demand, are freely offered at 13s. 6d. Coking unscreened are also slow, and are quoted nominally at 13s. 6d. to 13s. 9d. Good quality bunkers are abundant at 13s. 6d. There is a moderately good inquiry for best bunkers at 14s. 6d. to 15s. The demand for coke is slow, and, with increasing stocks in every grade, holders are pressing on the market. Best gas coke is quiet at 21s., and district makes are at 20s. Patent oven coke is in excessive supply at a nominal 16s. 6d. Beehive and superior grade coke is only made in accordance with definite orders, and values remain steady and unchanged at from 24s. to 28s. 6d.

Iron and Steel Imports.

Imports of iron and steel to the Tees still continue on a fairly heavy scale. Statistics presented at this week's meeting of the Tees Conservancy Commission showed that during January the foreign imports totalled 18,442 tons, as compared with 16,757 tons in December and 11,313 tons in November. The total for the last three months reached 46,512 tons, as against 42,419 tons in the corres-

ponding period of 1929–30 and 17,119 tons in the pre-war period of 1913–14. It should be noted, however, that little foreign iron is now being purchased, and the imports just now comprise deliveries under contracts fixed before the lowering of the home prices.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding.

THE output from Clyde yards during last month amounted to eight vessels of 31,642 tons aggregate. In January, 1930, the aggregate tonnage was 31,910 tons. The outlook at present is dull, there being every indication of quieter times ahead. The number of empty berths increases as vessels are brought to the launching stage, the number of fresh contracts being few and far between. The January, 1930, shipping under construction in Clyde yards amounted to about 550,000 tons, while the present figure is about 380,000 tons. The only order of importance reported during January was one for a large twin-screw suction hopper dredger. Of the vessels launched last month, four were of 4000 tons or over:—"Opawa," t.s. motor cargo liner, 9750 tons, built for the New Zealand Shipping Company, Ltd.; "Permian," Diesel-electric oil tanker, 9200 tons, for the Atlantic Oil Shipping Company; "Dalia," cargo steamer, 5200 tons, for the South African Railways and Harbours Administration; and a cargo steamer, 4400 tons, for the British Phosphates Commissioners, London.

Steel and Iron.

On the whole, the Scottish steel and iron markets are very quiet. Business generally is most restricted and confined to limited tonnages for prompt delivery. Steel-makers require orders for all classes of material, plants, as a rule, being poorly occupied. Orders for sheets are very slow, the reduction in galvanised descriptions having met with little response so far. The loss of business with India is most severe. There is no sign of any improvement in the tube trade, where orders on hand generally only admit of three days work per week. The prices of re-rolled steel bars have been subjected to several cuts, which so far have been practically fruitless. Present quotations are £6 17s. 6d. home and £6 10s. per ton export. Bar iron also is depressed. Owing to depletion of stocks, the number of blast-furnaces in operation in Scotland has been increased to ten. The demand has not increased, and outputs as a rule are more than sufficient. Prices are unchanged, as follows:—Hematite, 75s. at steel works; No. 1 foundry, 76s.; No. 3 foundry, 73s. 6d. per ton f.o.t. makers' works. Shipments of pig iron from Glasgow last week only amounted to 48 tons—34 tons foreign—compared with 1207 tons—375 tons foreign—in the same week last year. During this week 550 tons of pig iron from India were unloaded at Glasgow.

Coal.

The feature of the coal trade is the scarcity of screened coal for shipment, owing chiefly to the restriction of outputs under the quota system. First-class Fife-shire steams are perhaps the only exception to the rule. Orders from abroad are still confined to limited prompt supplies, and shippers are quite unable to secure forward business at present prices. Washed nuts are more plentiful and prices continue to weaken. Aggregate shipments amounted to 205,564 tons against 224,938 tons in the preceding week and 245,686 tons in the same week last year. The difficulties associated with the working of this quota system are becoming more and more apparent. In some cases in which orders against outputs were assured for some time ahead, the orders have had to be turned down, and the services of miners and other pit workers dispensed with for weeks at a time. The latest instance is in the case of a Shotts mine, which has just been closed for four weeks, thereby throwing 400 miners idle.

Coatbridge Technical College.

A new technical college with accommodation for 1100 students has been built at Coatbridge. The college, which was formally opened by Sir Thomas Hudson Beare, Regius Professor of Engineering and Dean of Science, Edinburgh University, has been erected at a cost of £85,000, £20,000 of which was contributed by the Miners' Welfare Committee.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

THE anthracite section of the coal industry continues in a very satisfactory condition and, from all accounts, very considerable sales have been effected over the current year, but scarcely the same can be said of the steam coal section. At the moment, collieries are fairly busy, but it would be idle to pretend that there is any real pressure, and there is evidence that weaker conditions are likely to prevail before very long. The fact is that the market is beginning to realise the effect of the recent stoppage of work in the coalfield. When work was resumed there was, it is true, a fairly active spell in the chartering of tonnage, and from this fact the conclusion might have been drawn that operations were going to be on a scale that would compensate for the loss occasioned by the stoppage. As, however, was pointed out at the time, there was no doubt that this demand was made up of orders which had been held in abeyance by reason of the suspension of operations in the coalfield and of a sprinkling of new orders; but now that these have been arranged for, it is becoming fairly plain that there is a distinct lull in business. Consumers abroad do not appear to be at all pressed for coals, and the inquiry all round is very slow. Orders on the market are so restricted that outward rates of freight are as low as ever they have been in some directions. According to the Great Western Railway Company's returns the total coal exports from the leading ports in this district last week were 444,700 tons. That was the highest figure for this year, but still it was much less than for the corresponding period of last year, when the quantity was 603,788 tons. Apart from the fact that the current demand for coals has fallen off, it must be admitted also that the amount of business being negotiated for delivery over a period is comparatively small. Up to now the Brazilian Central Railways have not made known what their requirements are, whilst other consumers abroad do not appear to be at all anxious to cover their needs ahead.

Coal Negotiations.

It is satisfactory to record that the negotiations carried on by the Joint Sub-committee appointed by the Conciliation Board to revise the coalfield agreement consequent upon the terms settled in London on January 15th last, have proceeded very smoothly, with the result that, at the conclusion of its meeting on Monday last, the announcement was made that the members had practically completed their work and would report to the Joint Board early next week, when there is to be a special meeting for the purpose of endorsing the new agreement. When it is signed the new agreement will operate for three years—that is, up to the beginning of 1934. Provision is made for points in dispute to go before an independent chairman, who has yet to be nominated, and who will be asked to give his award by the end of this month. The new agreement also provides for the eventuality of a further change in working hours at the mines next July, when, in the ordinary course of things, there will be a reversion to the seven-hour day, so that, in all the circumstances, it is not without hope that the conditions prevailing in the industry will be more stable and settled for a period of three years than has been the experience for some time past.

British Mannesmann Tube Works Dispute.

Details of the arbitrator's award in the recent dispute between the Mannesmann Tube Company at Landore and the Iron and Steel Trades Confederation concerning a proposed revision by the company of the working hours and wages, shows that a declaration is made for a two-shift system of nine and a-half hours, including half-an-hour for meals, for five days a week, with no production on Saturdays. The basis piecework rates and earnings are to be adjusted, but are not to exceed 2½ per cent. No reduction is to apply to earnings of £3 3s. per week or less, or in the case of datal workers. The abolition of one shift will necessitate the displacement of a number of workmen, but it is understood that the company are to endeavour to arrange sharing the work in order that dismissals shall be reduced as much as possible.

Merger of Ship-repairing Companies.

A further official announcement has been made regarding the merger of two of the largest ship-repairing firms in this district, viz., the Mount-Stuart Dry Docks, Ltd., and the Cardiff Channel Dry Docks and Pontoon Company, Ltd., and its associated concerns. Details of the proposed merger as agreed upon by the boards of these companies will be in the hands of the shareholders by the end of this week, but, in the meantime, Mr. John Elliott, the managing director of the Mountstuart undertaking, has also been appointed managing director of the Cardiff Channel Dry Docks and Pontoon Company, Ltd., and its subsidiary companies. The new combine will have control of over a dozen dry docks at Cardiff, Barry, Newport and Avonmouth, as well as engineering shops and works.

Traffic Returns.

The adverse effect of the stoppage of work in the Welsh coalfield at the beginning of this year is revealed in the statistics issued by the Great Western Railway Company, covering the six ports under its control. For the four weeks ended January 18th, imports and exports totalled 1,466,319 tons, made up of 278,104 tons imports and 1,188,215 tons exports. This compares with an aggregate of 2,910,159 tons for the corresponding period of 1930, this being made up of 340,952 tons imports and 2,569,207 tons exports. The figures relating to coal and coke exports show that the quantity was 1,035,470 tons, as compared with 2,361,695 tons, a reduction of 1,326,225 tons.

Current Business.

While most of the leading collieries are fairly well placed for early loading, the tone of the market is very quiet from the point of view of new business. All qualities of coal, with the exception of sized descriptions, are now obtainable at the minima. Coke and patent fuel display no feature, but pitwood is not coming along so freely, with the result that prices are slightly better at 24s. 6d. to 25s. 6d.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE STIRLING BOILER COMPANY, Ltd., asks us to announce that Mr. George Summers, its general manager, has been appointed a director of the company.

B. J. HALL AND CO., Ltd., ask us to announce that they have changed their head office from Chalfont House, Great Peter-street, S.W. 1, to Stourton House, Dacre-street, Victoria-street, Westminster, S.W. 1. Their telephone number has been changed to Victoria 5302–5306, but their telegraphic address is still "Inspect, Sowest, London."

REDLER PATENTS, of Sharpness, Glos., ask us to announce that the engineering department of their business has now been separated from Redler Patents, and is trading as the Redler Equipment Company, Sharpness, Glos., and that they have also opened a London office at Sentinel House, Southampton-row, W.C. 1, which is in charge of Mr. G. Gilbert Bell, M.I.E.E.

MR. JENS BACHE-WIIG has been appointed general manager of the Standard Electricitäts Gesellschaft A.G., Berlin, in which capacity he will have charge of the affairs of the following companies:—Ferdinand Schuchhardt, Berliner, Fernsprech-und Telegraphenwerk A.G.; Mix and Genest A.G.; Telephonfabrik Berliner A.G., and Suddeutsche Apparate Fabrik G.m.b.H., Nurnberg.

MR. CHARLES F. DYER, of Carbon Chambers, Hall Gate, Doncaster, asks us to announce that the partnership lately subsisting between Mr. H. W. Ravenshaw and himself, under the style and title of Ravenshaw and Dyer, has been dissolved, and that Mr. Ravenshaw retired from the firm as from December 31st, 1930. The practice as consulting engineers will be continued by Mr. Dyer at the address given, in the same firm name of "Ravenshaw and Dyer."

FARADAY HOUSE OLD STUDENTS' ASSOCIATION.—The following are the new officers of the F.H.O.S.A. for the current year:—President, G. R. J. Parkinson, M.I.E.E.; Vice-President, the Right Hon. the Earl of Rothes; Members of Council, R. C. Harpur, A.M.I.E.E., Dr. S. E. A. Landale, G. Whitmore, and H. C. Wilson.

THE ASSOCIATION OF EX-SIEMENS' MEN.—The second smoking concert of the Association of Ex-Siemens' Men took place at Gatti's Restaurant, King William-street, Strand, on January 28th, 1931, when members and their friends, numbering approximately 60, spent a very enjoyable evening. The chairman, Mr. G. Palgrave Simpson, gave an interesting survey of the electrical industry, in the early days, stressing the team spirit which existed in those days, which was evidently still existing oi the present Ex-Siemens' Association.

THE ANGLO-AMERICAN OIL TANKER "SARANAC."—The first launch of the year at the Hebburn Yard of Palmers' Shipbuilding and Iron Company, Ltd., took place on Tuesday, February 3rd, when the new 300ft. cargo-carrying centre portion of the tanker "Saranac" safely took the water. The ship was dry-docked on January 17th and work is now proceeding on the dividing of the hull into three portions at the forward and aft cofferdams and the removal of the old centre part. When ready the new portion will be placed in position and joined up, and it is hoped that the lengthened ship will be handed over to the Anglo-American Oil Company, Ltd., within about two months of her dry-docking. Last year a sister tanker, the "Cadillac," was similarly lengthened and she has since given very satisfactory results.

MR. W. G. SPENCE.—On January 30th, a party of past and present members of Council and founding members of the North-East Coast Institution of Engineers and Shipbuilders held a small dinner for the purpose of saying good-bye to Mr. W. G. Spence, general manager of George Clark, Ltd., of Sunderland, who is retiring from business and from residence on the North-East Coast. As a memento of the occasion, Mr. Spence was presented with silver salver, on which were engraved the signatures of all Members of Council and surviving founding members of the Institution. It also bears the following inscription:—"Presented to William Geddes Spence, Esq., by present and past Members of Council and founding members of the North-East Coast Institution of Engineers and Shipbuilders as a token of gratitude for the responsible part that he took in the establishing of the Institution in 1884, and an expression of good wishes on his retirement from business. 30th January, 1931."

BRITISH EMPIRE TRADE EXHIBITION.—The following points should be borne in mind by those intending to visit the Argentine specifically in connection with the Exhibition in 1931:—The weather in Buenos Aires at this time of the year is generally comparable to English summer weather, and similar clothing should therefore be brought. The vaccination regulations usually enforced will be waived for visitors to the Exhibition travelling first and second class or by tourist ship. Special arrangements have been made by the Exhibition authorities to enable the introduction free of duty of samples and propaganda materials and literature provided these are intended solely for use or distribution at the Exhibition. Further details of these arrangements can be obtained at the London office of the Exhibition, 5, Parliament Mansions, Victoria-street, London, S.W. 1. Advance hotel bookings are already heavy, and intending visitors are advised to make the necessary arrangements in this connection as quickly as possible.

LIVERPOOL ENGINEERING SOCIETY.—The annual dinner of the Liverpool Engineering Society was held in the Adelphi Hotel, Liverpool, on Thursday, January 29th. Mr. W. H. McMenemey was in the chair, and the principal guests were the Lord Mayor of Liverpool and the President of the Institution of Mechanical Engineers. There were only two toasts, that of "The Engineering Profession" and that of "The Guests." Mr. Richard D. Holt, who proposed the first, disclaimed all knowledge of engineering, but said he had a great admiration for engineers, and he extolled the great work they had done. Mr. Pendred, in responding, drew a comparison between the individualism of Englishmen in the past and their present tendency always to rely upon the Government. Whilst refusing to discuss the vexed problem of tariff reform, he invited engineers to ask themselves if they had done all they could in the way of self-protection by buying only British products and encouraging British inventors. In a very skilful speech, Mr. McMenemey managed to include most of the guests by name in proposing that toast. He spoke with hopefulness of the recovery of trade. He was sure that the good sense of the nation could, and would, find a way out of its present difficulties. The Lord Mayor responded to this toast in the same after-dinner vein which characterised the other speeches of a very successful evening.

DIESEL ENGINE USERS ASSOCIATION.—On Thursday evening of last week, January 29th, the President and Committee of the Diesel Engine Users Association invited members and guests to an informal dinner, which was held at the Coventry Restaurant, Wardour-street. The evening was a most enjoyable one, and it is hoped that the dinner will, in future, become an annual event. The guests were welcomed by the President, Mr. C. M. Mayson, and the toast of "The Guests" was replied to by Mr. H. Talbot, a past-chairman of the Chemical Engineering Group, and Mr. J. A. Reavell, the President of the Institution of Chemical Engineers. Both Mr. Talbot and Mr. Reavell referred to very happy relations which existed between the various technical institutions whose home was at present in Abbey House, but which they hoped would later be transferred to the new Institution building which is to be constructed in Westminster. Mr. Percy J. Still recalled the early days of the Diesel Engine Users Association, and said that the early hopes of the founders had been fully justified, and an increasingly useful development of the Association's work might be looked forward to. Other speakers included Mr. W. A. Tookey, a new member of Committee, and Engineer Rear-Admiral J. Hope Harrison and Mr. C. O. Milton, the honorary secretaries. During the evening many appreciative references were made to the value of the Association's annual report on Heavy-oil Engine Working Costs, which was presented and discussed at a general meeting of the Association held at Caxton House that same afternoon.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	16/- to 20/6
(1) Spanish	16/- to 19/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	16/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 15 0	—
No. 1 Foundry	3 16 0	—
No. 3 Foundry	3 13 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 10 0	3 10 0
No. 1	3 10 6	3 10 6
Cleveland—		
No. 1	3 1 0	3 1 0
Siliceous Iron	3 1 0	3 1 0
No. 3 G.M.B.	2 18 6	2 18 6
No. 4 Foundry	2 17 6	2 17 6
No. 4 Forge	2 17 0	2 17 0
Mottled	2 16 6	2 16 6
White	2 16 6	2 16 6
MIDLANDS—		
(c) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 6 0	—
" " Foundry	3 11 0	—
(c) Northampton—		
Foundry No. 3	3 7 6	—
Forge	3 2 6	—
(c) Derbyshire—		
No. 3 Foundry	3 11 0	—
Forge	3 6 0	—
(3) Lincolnshire—		
No. 3 Foundry	—	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 3 6 (*a*) / 4 5 6 (*b*) / 4 10 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 5 0	—
Second Quality Bars	8 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	10 5 0	—
Best Bars	11 0 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	9 15 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	8 15 0 to 9 5 0	—
Gas Tube Strip	10 17 6 to 11 0 0	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
" " (Land)	10 0 0	10 0 0
Ship Plates, ½in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	8 0 0	8 0 0
Sheets (Gal. Cor. 24 B.G.)	11 7 6	11 0 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
" " (Land)	10 0 0	—
Joists	8 15 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	6 10 0 to 9 0 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
" (Small Round)	7 2 6	—
Hoops (Baling)	10 0 0	9 15 0
" (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
" (Lancs. Boiler)	9 5 0	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	8 12 6 and 9 2 6	—
Intermediate Basic	7 2 6 and 7 12 6	—
Soft Basic	6 5 0	—
Hoops	10 5 0	—
Soft Wire Rods	7 15 0	—
MIDLANDS—		
Small Rolled Bars	7 7 6 to 8 5 0	—
Billets and Sheet Bars	5 12 6 to 6 10 0	—
Galv. Sheets, f.o.b. L'pool	11 0 0	—
(2) Staffordshire Hoops	9 10 0	—
(*d*) Angles	8 7 6	—
(*d*) Joists	8 15 0	—
(*d*) Tees	9 7 6	—
(*d*) Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 5 0	—

NON-FERROUS METALS.

SWANSEA—		
Tin-plates, I.C., 20 by 14	f.o.b.	15/3 to 15/6
Block Tin (cash)		112 2 6
" (three months)		113 12 6
Copper (cash)		43 8 9
" (three months)		43 3 9
Spanish Lead (cash)		12 18 9
" " (three months)		13 0 0
Spelter (cash)		11 15 0
" (three months)		12 5 0
MANCHESTER—		
Copper, Best Selected Ingots		46 0 0
" Electrolytic		46 15 0
" Strong Sheets		75 0 0
" Tubes (Basis Price), lb.		0 0 11
Brass Tubes (Basis Price), lb.		0 0 9½
" Condenser, lb.		0 1 0
Lead English		14 7 6
" Foreign		13 0 0
Spelter		12 5 0
Aluminium (per ton—raw ingot)	£95	

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	2/3 per lb.	
Ferro Tungsten	2/- per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	7/-
" " 6 p.c. to 8 p.c.	£22 10 0	7/-
" " 8 p.c. to 10 p.c.	£22 0 0	7/-
" " Specially Refined		
" " Max. 2 p.c. carbon	£32 10 0	10/-
" " " 1 p.c. carbon	£36 0 0	13/-
" " " 0·70 p.c. carbon	£40 0 0	14/-
" " " carbon free	11d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 0 0 for home	
" " "	£11 10 0 for export	
" Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/- per unit	
" " 75 p.c.	£18 10 0 scale 7/- per unit	
" Vanadium	12/9 per lb.	
" Molybdenum	4/2 per lb.	
" Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	15/-
" " Ell	15/6
" " Splint	16/6 to 17/6
" " Trebles	14/6
" " Doubles	13/- to 13/6
" " Singles	12/6 to 13/-
AYRSHIRE—	
(f.o.b. Ports)—Steam	15/- to 15/6
" " Jewel	18/-
" " Trebles	14/-
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	13/- to 13/6
Screened Navigation	16/6 to 17/6
Trebles	13/6 to 15/-
Doubles	12/3
Singles	12/-
LOTHIANS—	
(f.o.b. Leith)—Best Steam	14/-
Secondary Steam	14/-
Trebles	13/6 to 14/-
Doubles	12/9
Singles	12/3

ENGLAND.

	Export.
(8) N.W. COAST—	
Steams	20/-
Household	30/- to 51/-
Coke	20/- to 21/-
NORTHUMBERLAND—	
Best Steams	13/6 to 13/
Second Steams	12/6
Steam Smalls	10/- to 10/6
Unscreened	12/6 to 13/-
Household	27/- to 39/-
DURHAM—	
Best Gas	15/- to 15/6
Second	13/9 to 14/-
Household	25/- to 37/-
Foundry Coke	26/- to 28/-

SHEFFIELD—	Inland.	
Best Hand-picked Branch	25/6 to 27/-	—
Derbyshire Best Bright House	20/- to 22/6	—
Best House Coal	20/6 to 21/6	—
Screened House Coal	18/- to 19/-	—
" " Nuts	15/6 to 16/6	—
Yorkshire Hards	14/- to 15/6	—
Derbyshire Hards	14/- to 15/6	—
Rough Slacks	8/6 to 9/-	—
Nutty Slacks	6/6 to 7/-	—
Smalls	3/- to 5/-	—

Blast-furnace Coke (Inland).. 12/- on rail at ovens
Furnace and Foundry Coke (Export), f.o.b. 15/- to 16/-

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	20/- to 20/3
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 19/6
Ordinary Dry Large	17/9 to 18/-
Best Black Vein Large	18/3 to 18/6
Western Valley Large	17/9 to 18/-
Best Eastern Valley Large	17/6 to 17/9
Ordinary Eastern Valley Large	17/3 to 17/6
Best Steam Smalls	14/- to 14/3
Ordinary Smalls	12/- to 13/6
Washed Nuts	18/- to 22/-
No. 3 Rhondda Large	19/9 to 20/3
" " Smalls	15/6 to 16/-
No. 2 " Large	17/- to 17/3
" " Through	15/6 to 16/-
" " Smalls	14/- to 14/3
Foundry Coke (Export)	22/6 to 36/6
Furnace Coke (Export)	17/6 to 18/-
Patent Fuel	21/6
Pitwood (ex ship)	24/6 to 25/6
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	35/- to 37/6
Seconds	27/- to 31/6
Red Vein	22/6 to 27/6
Machine-made Cobbles	41/6 to 45/-
Nuts	43/- to 46/-
Beans	24/9 to 28/3
Peas	20/3 to 21/6
Breaker Duff	9/6 to 10/6
Rubbly Culm	8/6 to 9/-
Steam Coals:	
Large	20/- to 21/6
Seconds	18/- to 20/-
Smalls	12/- to 13/-
Cargo Through	17/- to 18/-

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum), 22/6; Ordinary Ship, Bridge, and Tank Plates and Sections, 15/- if home consumers confine purchases from associated British Steel Makers. (*e*) Delivered Black Country Stations.

French Engineering Notes.

(From our own Correspondent in Paris.)

Merchant Marine.

A PARLIAMENTARY report upon the situation of the French merchant marine shows that on June 30th, 1930, there was, including the fishing fleet, a total of 3,530,879 tons, or 150,000 tons more than in the previous year, and in view of the building that has continued since then there is every probability of a further substantial increase. The total still leaves France only sixth in the list of maritime countries, after Great Britain, the United States, Japan, Germany and Norway. So far as the fishing fleet is concerned, France comes second after Great Britain with 123,794 tons; but in cargo boats and oil tankers of between 6000 and 8000 tons this country falls to the eighth position. In motor ships, also, France is low down on the list with 146,000 tons. The fleet is being modernised, and last year there were 428.495 tons of shipping less than five years old and close upon a million tons between five and ten years of age. Since then the fleet has been increased by new vessels, and at the end of September last there were twenty-two vessels with a total of 209,307 tons on the stocks in French shipyards, while between 40,000 and 50,000 tons of shipping had been ordered abroad. During the past week work was begun on the super liner to be constructed for the Compagnie Générale Transatlantique at the Penhoët shipyard at Saint-Nazaire.

Standardisation.

One of the objects of consolidating the shipbuilding industry by the recent formation of the Union of French Shipbuilders was to carry out an organisation for facilitating work and cheapening production, principally by standardising material and reducing the number of sizes, so that home manufacturers could prepare to turn them out for quick delivery. In 1929 a commission was formed to standardise shipbuilding material under the presidency of Monsieur Berlhe, managing director of the Bureau Veritas, and it is now engaged in reforming the old standards, a work which will take a considerable time. Except in the case of ship plates and rolled sections, the necessity of interchangeability will not allow of any great departure from the proposed international standards, although in all cases there will be fewer French standards, and makers of winches and windlasses are being consulted upon new chain dimensions so that they will not interfere with the use of foreign chains. The form and dimensions of the links are likely to be modified. There will be fewer standards of ship plates and sections, all of them being, of course, to metric dimensions. This work is being carried out simultaneously with that of the International Federation of National Committees on Standardisation, the technical direction of which is in Holland, and presumably the new French standards will be submitted to the International Federation, as is the case with other countries.

Coal.

Until the beginning of last year the French coal mining industry had suffered little from the causes that had brought about a depression in other countries, but since then, while slightly increasing the output, coal-owners find it necessary to provide for a situation that is by no means reassuring. During 1930 the production totalled 55,026,768 tons, including 1,142,733 tons of lignite, this latter material being used mainly for the manufacture of composite fuels. Including imports, the total amount of coal available was 75,686,569 tons, or about a million tons more than in the previous year. While the imports of British coal were maintained, those from Belgium and the Dutch Limburg, which compete directly with French coal in the northern departments, increased considerably, and that is seriously affecting the position of home coal owners who have been loath to discharge men and have therefore been accumulating large stocks of fuel, which have now grown to such an extent that the colliery companies in the Nord arranged last week to lay off one day in a fortnight. At some collieries pits have been closed. In one case one-half of the men have been discharged, and recently increasing numbers of miners have been thrown out of work at other collieries. An international arrangement for the production and distribution of coal is believed to be the only satisfactory method of dealing with the situation, if it can possibly be effected; but it is now recognised that the difficulties in the way of an international agreement are so numerous as to be almost insuperable. Therefore the obvious remedy is to meet foreign competition by reducing prices, which can only be effected by a lowering of wages, and that is what the coalowners are believed to have the intention of doing.

Railway Pneumatic Tires.

There is some curiosity about experiments which have been carried out for some months past on the local line between Issoudun and Saint-Florent. The well-known tire manufacturer, Monsieur Michelin, fitted some motor coaches with pneumatic tires with the idea of demonstrating that they ensure the silent and smooth running of trains and that the absence of jolting and shocks will lengthen the life of rails. The experiments on the motor rail vehicles were regarded as so far satisfactory that engineers from the different railway companies were invited last week to visit Issoudun and witness the demonstration.

The Steel Trade.

The diminishing consumption of iron and steel is not the only reason for the weakening of prices which the comptoirs are unable to maintain. Offers from Belgium and the Saar are depressing the market, and it is supposed that Belgian producers, especially, are endeavouring to get orders at almost any price in the hope that a larger volume of business will enable them to insist on a larger quota should the Steel Cartel be renewed at the end of next month.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

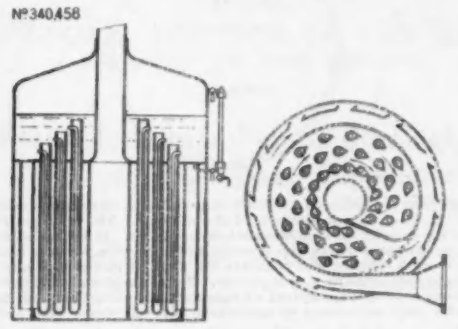
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

340,458. April 9th, 1930.—WASTE HEAT BOILERS, Deutsche Werft Aktiengesellschaft, Postfacht 889, Hamburg 1, Germany.

The object of this invention is to provide a waste heat boiler for use in conjunction with the exhaust of internal combustion engines which can be readily adapted to the immediate requirements for steam regardless of the output of the main engines.

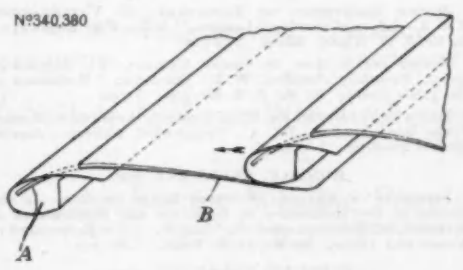


It takes the form of a Field-tube boiler, into which the exhaust gases are brought tangentially, so that any sparks may be separated centrifugally. The means for determining the steam output of the boiler is the arrangement of the top ends of the Field tubes, which, as will be seen, vary in height. By lowering the water level in the boiler, the groups of tubes are successively uncovered, and consequently go out of action in the matter of steam raising.—*January 1st*, 1931.

TURBINE MACHINERY.

340,380. November 19th, 1929.—FLEXIBLE TURBINE BLADES, U. Antoni, 56, Via Ugo Foscolo, Viareggio, Italy.

The inventor claims to obtain a greater efficiency in turbines by making the blades flexible, so that they will respond to

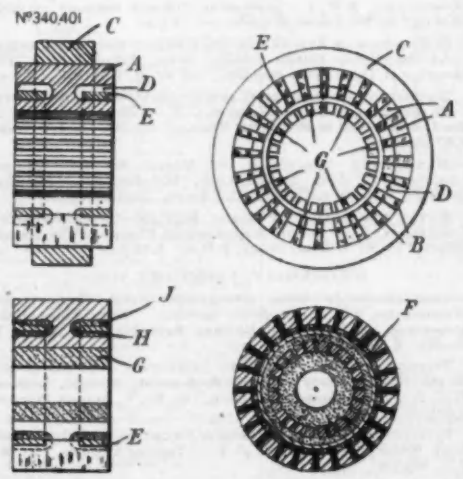


variations in pressure. The blade is made in two pieces. A rigid bar A and a flexible blade B, which is tapered in thickness to provide greater flexibility towards the trailing edge.—*January 1st*, 1931.

DYNAMOS AND MOTORS.

340,401. December 10th, 1929.—COMMUTATORS FOR DYNAMO-ELECTRIC MACHINES, Anton Wörner, of Kronprinzstrasse, Vaihingen on the Fildern, Wurtemberg, Germany.

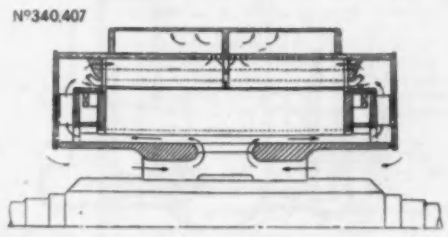
The commutator described in this specification comprises the copper segments A and the interposed mica bars B, which are secured in position when assembled by the removable hold-



ing ring C. The copper segments A are provided in axial direction with the notches D, each of which is in engagement with a seamless ring, such as the iron ring E against the periphery of which the mica bars B bear. During the subsequent shrinking of the commutator the copper segments A and the mica bars B will be forced radially to the inside, the mica bars holding the iron rings centrally, and being upset so as to form a broad support or the iron rings E, and, in addition, being protected against centrifugal displacement because their base F is broadened and firmly embedded in the compressed insulating composition G, which forms the hub of the commutator. It also fills up the intervening spaces between the copper segments A and the annular spaces H between the base of the copper segments and the rings E, and the space between the rings E and the outer part of the copper segments, so that each iron ring E is insulated in every direction and embedded in the notches D of the copper segments. A commutator constructed according to the invention is said to be capable of withstanding 20,000 revolutions per minute at 200 deg. Cent. without showing the least deformation.—*January 1st*, 1931.

340,407. December 20th, 1929.—DYNAMO-ELECTRIC MACHINES, Gustaf Adolf Juhlin, of "Redscar," Moss-lane, Timperley, Cheshire, and Associated Electrical Industries, Ltd., of Bush House, Aldwych, Westminster.

This invention relates to dynamo-electric machines, and comprises improved cooling arrangements applicable more particularly, but not exclusively, to machines having small air gaps and cylindrical rotors of considerable axial length, such, for instance, as high-frequency generators and induction motors. Cooling air enters the machines at each end through relatively large axial ducts in the rotor spider, and passes towards the centre of the machine, and thence radially outwards through openings into axial passages between the exterior of the spider and the inner periphery of the rotor laminations, which maybe shaped to provide serrations for increasing the cooling surface.

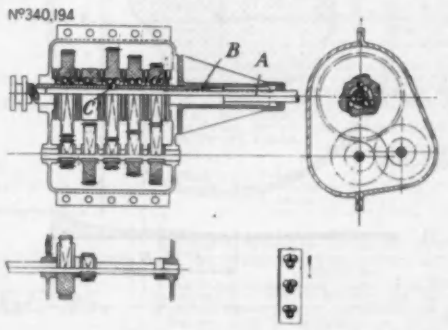


The air passes from the passages to both ends of the machine through a fan attached to the rotor at each end. The stator laminations are provided preferably near their outer periphery with axial ducts, so that the air drawn by the fans through the rotor enters the axial stator ducts from both ends of the machine and passes towards the centre. The axial stator ducts are provided near the centre of the machine with radial outlets, through which the cooling air can pass into an annular space within the stator frame, and thence through openings in the latter to the atmosphere. A guide baffle may be placed so that the air drawn through the fan is directed over or through the stator end winding towards the axial stator ducts. By means of these cooling arrangements the ventilation is symmetrical from each end of the machine and the temperature is more or less uniform.—*January 1st*, 1931.

TRANSMISSION OF POWER.

340,194. April 9th, 1930.—GEAR CHANGING MECHANISM, J. Brian, 38, Marlborough-road, Newport, Mon., and J. C. Brian, 2, Madison-avenue, Cheadle Hulme, Cheshire.

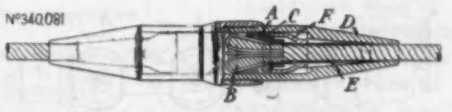
This gear-box is of the constant mesh type, and the invention is concerned with the means for clutching the several gear wheels on to the driven shaft A. This shaft is surrounded by a sleeve B, with which it is connected by a feather key. The



gear wheels run on this sleeve on double rows of balls, which are shrouded to the extent of half their diameter within the bore of the wheels. Another set of balls C is partially shrouded in the sleeve B. By sliding the sleeve along, the balls C can be brought into engagement with the balls of any one of the gear wheels, and, by a jamming action, transmit the drive.—*December 24th*, 1930.

340,081. October 29th, 1929.—APPARATUS FOR JOINING TOGETHER STRANDED WIRE CABLES OR FOR ANCHORING THE ENDS, John Somerville Highfield, of 36, Victoria-street, London, S.W. 1.

This invention relates to methods of and apparatus for joining together stranded wire cables or for anchoring the ends of such cables by the use of conical members engaging the cable and strands within a sleeve. The invention is particularly applicable to cables such as electrical transmission cables which consist of a core built up from a heart wire and a number of surrounding wires, the core being surrounded in turn by one or more further layers of wire; for example, the core may be made of



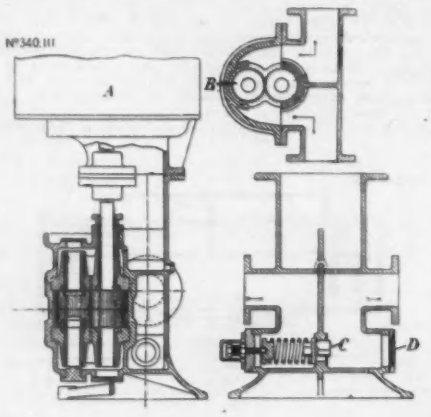
steel and the outer layers of copper or aluminium. The central strands A of the cable are bent around an externally conical member B, having rounded ends, and are clamped between the member B and an internally conical member C, fitting closely within the sleeve D. The outer strands for the cable which are cut short, so as to allow the inner strands A to project are caught within a split smooth-bored externally conical member E, which is formed with a number of longitudinal cuts so that in effect it acts as a series of wedges. This member E fits within the end of the sleeve D, which is made internally conical. The edges of the longitudinal gap are made radial, so that, if the gap closes, the edges will lie in close contact with one another. A distance piece

F is interposed between the member C and the member E. Thus when tension is applied to the cable the inner strands A take a considerable part of the load which is transmitted to the member B, from it through the inner strands to the member C, and from it through the distance piece F to the member E. The remainder of the load is taken by the clamping action of the member E which surrounds all the strands of the cable.—*December 24th*, 1930.

PUMPING AND BLOWING MACHINERY.

340,111. December 22nd, 1929.—GEAR WHEEL PUMPS, Drysdale and Co., Ltd., Bon-Accord Works, Ferry-road, Yoker, Glasgow.

This pump is intended for forced lubrication purposes, and is, as will be seen, of the toothed gear type, driven by a motor A. The chief claim for novelty appears to lie in the arrangement of

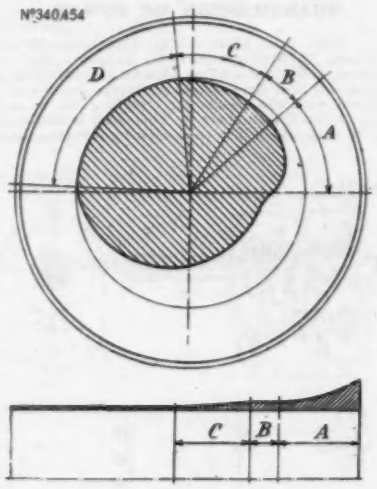


the casing, so that the idler wheel B may be drawn away with one half of the casing for inspection or repair without disturbing the pipe connections. The relief valve C may also readily be moved from the position shown to the opposite side at D if it is desired to reverse the direction of flow through the pump.—*December 24th*, 1930.

MACHINE TOOLS AND SHOP APPLIANCES.

340,454. March 20th, 1930.—THE MANUFACTURE OF SEAMLESS TUBES IN A PILGER MILL, L. Klein, 153, Gessesheimerstrasse, Düsseldorf, Germany.

This invention is concerned with the manufacture of seamless steel tubes by the Pilger process—that is to say, that in which

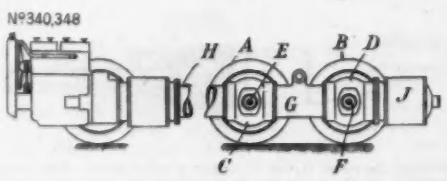


the hollow billet is passed, step by step, through an excentric set of rolls for its reduction to a thin walled tube. It is claimed that the formation of roll—illustrated—but concerning which no very precise data are given, enables tubes of lighter gauge to be produced than has hitherto been possible. The illustration must be left to describe the invention.—*January 1st*, 1931.

MOTOR CARS AND ROAD TRAFFIC.

340,348. October 9th, 1929.—ELECTRICALLY-DRIVEN AUTOMOBILE VEHICLES, Tatra-Werke Automobil und Waggonbau A.-G., of 200, Prague-Smichov, Czechoslovakia.

This invention relates to electrically-driven vehicles, in which a tubular hollow body arranged in the centre line of the vehicle forms the underframe. The invention relates more particularly to those vehicles in which the current serving for feeding the motor is supplied by a generator, driven by an internal combustion engine. The motor casing or the generator casing forms

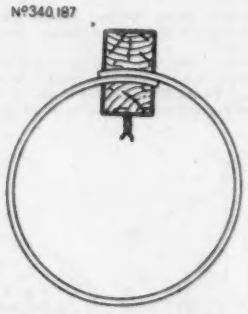


a part or a continuation of the tubular underframe. Two pairs of driving wheels A and B are supported on half axles, which are pivoted to differential casings C and D. The driving of the wheels is effected by means of shafts E and F, journalled in the half axles. The differential casings form part of a tubular underframe, the main portion of which consists of preferably seamlessly drawn tubes G and H. The casing of an electric motor J, serving for driving the wheels, is overhung on the rear portion of the rear differential casing D, being secured preferably by means of flanges, and forms a continuation of the tubular underframe. The current serving for feeding the electric motor is generated by a generator shown coupled to an engine on the left of the illustration, the casing of the generator forming part of the tubular underframe.—*January 1st*, 1931.

MISCELLANEOUS.

340,187. March 19th, 1930.—MANUFACTURING DRAIN PIPES FROM VENEER, A. Hönningstad, Forus, near Stavanger, Norway; A. Arneson, of the same address, and A. Norheim, Hinna, near Stavanger.

The inventors propose to make drain pipes of pine wood veneer, as they are lighter than the usual tile drain. The veneer, in lengths of about 1 m., is bent into the form of a pipe and the



lap joint is reinforced by two laths, while the fastening is made by loops of wire at intervals of about 10 cm. The laths project at the ends for the alignment of lengths of pipe. It will be noticed that the twist in the wire is made inside the pipe, so as to leave a smooth exterior and facilitate the drawing of the pipe into a drain hole made by a mole plough. No hint is given in the specification as to the method of manufacture, except that all the wire loops are twisted up simultaneously.—*December 24th*, 1930.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London, S.W. 1. Adjourned discussion, "High-pressure Locomotives," by Mr. H. N. Gresley. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Informal meeting. Lecture, "Aerial Wire Ropeways," by Mr. J. W. White. Slides. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, Piccadilly, London, W. 1. Discourse, "Mechanics of the Trade Slump," by Mr. J. M. Keynes. 9 p.m.

RAILWAY CLUB.—In the Royal Scottish Corporation Rooms, Fetter-lane, London, E.C. 4. Presidential address. Annual general meeting. 7.30 p.m.

MONDAY, FEBRUARY 9TH.

INSTITUTE OF METALS: SCOTTISH LOCAL SECTION.—In the Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. "Gas Refinement of Metals and Alloys," by Mr. D. R. Tullis. 7.30 p.m.

TUESDAY, FEBRUARY 10TH.

INSTITUTE OF MARINE ENGINEERS.—The Minories, London, E.C. 3. "Water-tube and Scotch Boilers," papers by Mr. Harold E. Yarrow and Mr. Summers Hunter, jun. 6 p.m.

INSTITUTE OF METALS: NORTH-EAST COAST LOCAL SECTION.—In the Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "Stress in Metals," by Mr. A. Wragg. 7.30 p.m.

INSTITUTE OF METALS: SWANSEA LOCAL SECTION.—At the Y.M.C.A., Swansea. "Application of Copper to the Building Trade," by Mr. Julius Frith. 6.15 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—King's Head Hotel, Coventry. Daimler Premium paper, "The Compression-ignition Automobile Engine," by Mr. S. W. Nixon. 7.30 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, Westminster, S.W. 1. Discussion, "Some Methods of Gold Mining," by Mr. James Whitehouse. 6 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: SCOTTISH CENTRE.—At the North British Station Hotel, Edinburgh. "The Metering of Three-phase Supplies," by Mr. O. Howarth. 7 p.m.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.—39, Elmbank-crescent, Glasgow, C. 2. "Electric Welding in the Construction of Sea-going Vessels," by Mr. Gustav Wahl. 7.30 p.m.

MANCHESTER GEOLOGICAL AND MINING SOCIETY.—Queen's Chambers, 5, John Dalton-street, Manchester. "Pumping in Mines," by Mr. J. Duckworth. 4 p.m. Council 3 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—Albemarle-street, London, W. 1. "Recent Experimental Physics: The Raman Effect," by Sir William Bragg, F.R.S. 5.15 p.m.

WEDNESDAY, FEBRUARY 11TH.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, Westminster, S.W. 1. Students' meeting. "Some Notes on the Inspection and Testing of Railway Materials," by Mr. A. T. Black. 6 p.m.

INSTITUTION OF ENGINEERING INSPECTION.—At the Rooms of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. "Steel Foundry Welding," by Mr. V. Gordon Pearson. 5.30 p.m.

INSTITUTION OF ENGINEERS-IN-CHARGE.—Brooklyn Hall, Bush House, West Wing, W.C. 2. "Talking Pictures," by Mr. J. I. Martin. 7.30 p.m.

INSTITUTION OF HEATING AND VENTILATING ENGINEERS.—In the Hotel Russell (Bedford Room), Russell-square, London, W.C. 1. Annual General Meeting. Presidential address by Mr. Sam. Fox. "Boilers and Metals," by Mr. W. G. Case and Mr. W. E. Dennison. 2.30 p.m. Dinner at 6.30 p.m. for 7 p.m.

NEWCOMEN SOCIETY.—At the Science Museum (Demonstration Room 1), South Kensington, S.W. 7. "The 16th Cent. Chain Pump at Hampton Court," by Mr. G. F. Zimmer. 5.30 p.m.

THURSDAY, FEBRUARY 12TH.

INSTITUTE OF METALS: LONDON LOCAL SECTION.—Joint meeting with Electroplaters' and Depositors' Technical Society in the Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W. 1. "Electrolytic Processes in Metallurgy," by Dr. H. J. T. Ellingham. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS.—Connaught Rooms, Great Queen-street, W.C. 2. Annual dinner. 7 p.m. for 7.30 p.m.

INSTITUTION OF WELDING ENGINEERS.—At the Institution of Mechanical Engineers, Storey's-gate, St. James's Park, London S.W. 1. "Welding Practices and Methods Based on My Own Experiences," by the Winner of the Operative Welders Prize Competition, 1930. 7.45 p.m.

OPTICAL SOCIETY.—At the Imperial College of Science and Technology, Imperial Institute-road, South Kensington, S.W. 7. "Modern Optical Glass as Exemplified by the List of the Parsons Optical Glass Company, dated September, 1926," by Mr. T. Smith; "On the Fixed Points of a Colorimetric System," by Mr. J. Guild. Demonstrations will be given of the following:—The Moll microphotometer, the Pulfrich photometer, the Recording Microphotometer of the Cambridge Instrument Company, Ltd. 7.30 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Cleveland Scientific and Technical Institution, Corporation-road, Middlesbrough. Tees-side Branch. "Notes on the Modern Manufacture of Machine-cut Gears," by Mr. A. Richardson. 7.30 p.m.

FRIDAY, FEBRUARY 13TH.

FARADAY HOUSE OLD STUDENTS' ASSOCIATION.—Hotel Russell, Russell-square, London, W.C. 1. Supper dance. 8 p.m. to 2 a.m.

INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—In the Non-Ferrous Section of the Applied Science Department of the University, St. George's-square, Sheffield. "The Applications of High-nickel, Nickel-copper Alloys and Pure Nickel in Industry," illustrated by a cinematograph film, by Mr. N. C. Marples. 7.30 p.m.

INSTITUTION OF LOCOMOTIVE ENGINEERS (LONDON): MANCHESTER CENTRE.—In the Building of the Manchester Literary and Philosophical Society, 36, George-street, Manchester. "The Development of the Piston Valve to Improve Steam Distribution," by Mr. D. W. Sanford. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—At 39, Victoria-street, S.W. 1. Ordinary meeting. Honorary member's lecture, "Monolith Foundations," by Mr. H. Cartwright Reid. 7.30 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Lecture Theatre, Mining Institute, Newcastle-on-Tyne. "Ship Wave Resistance: An Examination and Comparison of the Speeds of Maximum and Minimum Resistance in Practice and in Theory," by Mr. W. C. S. Wigley. 6 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—Albemarle-street, Piccadilly, W. 1. Discourse, "Ultrasonics: Some Properties of Inaudible Sound," by Professor F. Lloyd Hopwood. 9 p.m.

SOCIETY OF CHEMICAL INDUSTRY: CHEMICAL ENGINEERING GROUP.—Lecture Theatre, the Institution of Civil Engineers, Great George-street, Westminster, S.W. 1. "Silver and its Application to Chemical Plant," by Mr. Donald MacDonald. 6.30 p.m.

SATURDAY, FEBRUARY 14TH.

STAFFORDSHIRE IRON AND STEEL INSTITUTE.—At the Dudley Arms Hotel, Dudley. Annual dinner. 6.30 p.m.

MONDAY, FEBRUARY 16TH.

INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—In the Non-ferrous Section of the Applied Science Department of the University, St. George's-square, Sheffield. Conjoint meeting for discussion on "Refractories for Heating and Melting Furnaces." 7.30 p.m.

MONDAY TO FRIDAY, FEBRUARY 16TH TO 27TH.

BRITISH INDUSTRIES FAIR, 1931.—Castle Bromwich, Birmingham; Olympia and White City, London. Open 9.30 a.m. daily.

TUESDAY, FEBRUARY 17TH.

IMPERIAL INSTITUTE.—South Kensington, S.W. 7. Exhibition of the Mineral Resources of the Empire.

INSTITUTION OF MECHANICAL ENGINEERS.—Official visit to the British Industries Fair, Birmingham.

WEDNESDAY, FEBRUARY 18TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Metropole Hotel, Leeds. "Rustless Steels as Applied to Automobiles and Aircraft," by Dr. W. H. Hatfield. 7.15 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The Engineers' Club, Albert-square, Manchester. "Light Alloy Piston Development," by Mr. E. V. Pannell. 7 p.m.

OVERHEAD LINES ASSOCIATION.—At the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, London, W.C. 2. Discussion on "Wayleaves." 5.30 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. "The Art of the Bridge Builder," by Mr. Gavin Heynes Jack. 8 p.m.

FRIDAY, FEBRUARY 20TH.

INSTITUTE OF METALS.—Official visit to the British Industries Fair at Birmingham. Full particulars may be obtained from Dr. G. Shaw Scott, 36, Victoria-street, London, S.W. 1.

JUNIOR INSTITUTION OF ENGINEERS.—At Royal United Services Institution, Whitehall. Special meeting. "Notes on the Construction of the Variable Density Tunnel for the National Physical Laboratory at Teddington," by Mr. A. J. Grant. 7.30 p.m.

MANCHESTER ASSOCIATION OF ENGINEERS.—Midland Hotel, Manchester. Annual dinner. 6.45 for 7.15 p.m.

SATURDAY, FEBRUARY 21ST.

FINSBURY TECHNICAL COLLEGE OLD STUDENTS' ASSOCIATION.—At the Trocadero Restaurant. Annual dinner. Tickets from Mr. F. R. C. Rouse, 15, Clifton-gardens, Golders Green, London, N.W. 11.

TUESDAY, FEBRUARY 24TH.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.—39, Elmbank-crescent, Glasgow, C. 2. "Supercharging, with Special Reference to Werkspoor Engines," by Mr. G. J. Lugt. 7.30 p.m.

THURSDAY, FEBRUARY 26TH.

INSTITUTE OF METALS: BIRMINGHAM LOCAL SECTION.—In the Chamber of Commerce, New-street, Birmingham. "Press Tools for Sheet Metal Working," by Mr. J. L. Williams. 7 p.m.

FRIDAY, FEBRUARY 27TH.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. "Oil Engines for the Maritime Fishing Industry," by Mr. W. A. Tookey. 7.30 p.m.